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TECHNICAL MANUAL

MAINTENANCE/OVERHAUL
INSTRUCTIONS

FLIGHTLINE
TOW TRACTOR
MODEL NO. 3

NSN 1740-01-173-0520YW

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3-1	0	FP-4 Blank	0		
3-2	1	FP-5	0		
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4-30	1				
4-30.1 Added	1				
4-30.2 Blank Added	1				
4-31 - 4-33	0				
4-34 Blank	0				
5-1 - 5-2	0				
5-3	1				
5-4 - 5-7	0				
5-8 - 5-9	1				

*Zero in this column indicates an original page

TABLE OF CONTENTS

Chapter		Page
	LIST OF ILLUSTRATIONS	vii
	LIST OF TABLES	xi
	SAFETY SUMMARY	xiii
	INTRODUCTION	xix
1	GENERAL INFORMATION	1-1
1-1	Purpose of Equipment	1-1
1-2	General Description	1-1
1-3	Detailed Description	1-1
1-3.1	Frame	1-1
1-3.2	Engine	1-1
1-3.3	Transmission	1-2
1-3.4	Brakes	1-2
1-3.5	Steering System	1-2
1-3.6	Electrical System	1-3
1-3.7	Cooling System	1-3
1-3.8	Fuel System	1-3
1-3.9	Exhaust System	1-3
1-3.10	Air System	1-4
1-3.11	Winterization System	1-4
2	SPECIAL TOOLS AND TEST EQUIPMENT	2-1
2-1	General	2-1
3	PREPARATION FOR USE	3-1
3-1	General	3-1
3-2	Preliminary Inspection	3-1
3-2.1	Visual Inspection	3-1
3-2.2	Item Check	3-1
3-3	Switches, Gauges and Lights	3-2
3-4	Operational Check	3-2
3-5	Lubrication	3-2
4	IN-USE INSPECTION, MAINTENANCE AND LUBRICATION	4-1
4-1	Introduction	4-1
4-2	Malfunction Analysis and Remedial Action	4-1
4-3	Scheduled Inspection	4-1
4-4	Periodic Maintenance and Adjustments	4-1
4-4.1	Fuel System Service	4-21
4-4.2	Cooling System Service	4-21
4-4.3	Belt Service	4-22
4-4.4	Engine Oil and Oil Filter Change	4-22
4-4.5	Brake System Service	4-22
4-4.6	Battery and Cable Service	4-25
4-4.7	Engine Performance Checks	4-25
4-4.8	Engine Tune-Up	4-25
4-4.9	Exhaust System Service	4-25
4-4.10	Transmission Service	4-25
4-4.11	Transfer Case Service	4-27
4-4.12	Propeller Shaft Service	4-27
4-4.13	Steering System Service	4-28
4-4.14	Differential Service	4-28
4-4.15	Wheels and Tires Service	4-28

TABLE OF CONTENTS-Continued

Chapter		Page
4-4.16	Frame Service	4-30
4-4.17	Windshield Wiper Service	4-30
4-4.18	Air System Service	4-30
4-4.19	Winterization System Service	4-30.1
4-5	Lubrication	4-30.1
5	OVERHAUL PROCEDURES	5-1
5-1	General	5-1
5-2	Scope	5-1
5-2.1	General Maintenance Procedures	5-1
5-2.2	Overhaul Procedures	5-1
5-3	Consumable Materials	5-1
5-4	General Maintenance Procedures	5-3
5-4.1	General Removal Instructions	5-3
5-4.2	General Disassembly Instructions	5-3
5-4.3	General Cleaning Instructions	5-4
5-4.4	General Inspection Instructions	5-5
5-4.5	General Repair Instructions	5-7
5-4.6	General Reassembly and Installation Instructions	5-8
5-5	Overhaul Procedures	5-9
5-5.1	Engine	5-10
5-5.1.1	Air Filter Assembly and Duct Group	5-10
5-5.1.2	Positive Crankcase Ventilation System	5-11
5-5.1.3	Venturi and Dashpot Assembly Group	5-12
5-5.1.4	Intake and Exhaust Manifolds Group	5-13
5-5.1.5	Exhaust System	5-14
5-5.1.6	Alternator, Starter and Vacuum Pump Mounting Parts Group	5-16
5-5.1.7	Starting Motor Assembly	5-18
5-5.1.8	Alternator and Vacuum Pump Group	5-24
5-5.1.9	Battery and Mounting Group	5-29
5-5.1.10	Belts Group	5-32
5-5.1.11	Water Pump and Fan Group	5-33
5-5.1.12	Radiator, Hose and Coolant Recovery Group	5-35
5-5.1.13	Fuel Lines Group	5-37
5-5.1.14	Fuel Pump and Fuel Filter Assembly Group	5-39
5-5.1.15	Injector Nozzles and Tubes Group	5-41
5-5.1.16	Oil Cooler and Filter Group	5-43
5-5.1.17	Engine Front Cover Group	5-45
5-5.1.18	Governor Assembly Installation	5-46
5-5.1.19	Governor Assembly	5-48
5-5.1.20	Injection Pump Assembly	5-50
5-5.1.21	Rocker Cover and Cylinder Head Group	5-55
5-5.1.22	Camshaft and Valve Train Group	5-57
5-5.1.23	Diesel Pre-Heating Group	5-60.1
5-5.1.24	Crankshaft Pulley and Flywheel Group	5-63
5-5.1.25	Engine Oil Pan Group	5-64
5-5.1.26	Oil Pump Group	5-65
5-5.1.27	Piston, Connecting Rod and Crankshaft Group	5-68
5-5.1.28	Engine Block Group	5-73
5-5.1.29	Front Engine Mounts Group	5-77
5-5.1.30	Rear Engine Mounts Group	5-78
5-5.1.31	Fuel Tank Assembly	5-80
5-5.2	Transmission	5-82

TABLE OF CONTENTS-Continued

Chapter		Page
5-5.2.1	Shifting With Automatic Transmission on Column	5-82
5-5.2.2	Throttle Valve Linkage Group	5-83
5-5.2.3	Transmission Cooling Lines Group	5-83
5-5.2.4	Transmission Assembly and Case Assembly Group	5-85
5-5.2.5	Torque Converter Group	5-88
5-5.2.6	Servo and Valve Body Group	5-90
5-5.2.7	Governor Control Group	5-93
5-5.2.8	Clutches Group	5-95
5-5.2.9	Gears and Shafts Group	5-99
5-5.3	Transfer Case and Propeller Shaft	5-102
5-5.3.1	Rear Propeller Shaft Group	5-102
5-5.3.2	Transfer Case Assembly and Transfer Case Housing Group	5-104
5-5.3.3	Transfer Case Gear and Shafts	5-107
5-5.3.4	Transfer Case Shift Forks Group	5-113
5-5.3.5	Deleted	
5-5.4	Steering	5-114
5-5.4.1	Steering Wheel Group	5-114
5-5.4.2	Steering Column Assembly and Upper Housing Group	5-115
5-5.4.3	Steering Column Lower Housing and Shafts Group	5-119
5-5.4.4	Steering Gear Components Group	5-121
5-5.4.5	Steering Linkage Group	5-129
5-5.4.6	Steering Damper Group	5-131
5-5.4.7	Power Steering Pump Mounting Group	5-132
5-5.4.8	Power Steering Hydraulic Pump Assembly	5-134
5-5.5	Front Axle and Suspension	5-137
5-5.5.1	Front Shock Absorber Group	5-137
5-5.5.2	Front Stabilizer Bar Group	5-138
5-5.5.3	Front Spring Group	5-140
5-5.5.4	Front Axle Housing Group	5-143
5-5.6	Rear Axle and Suspension	5-145
5-5.6.1	Rear Shock Absorber Group	5-145
5-5.6.2	Rear Spring Group	5-146
5-5.6.3	Rear Axle Assembly and Rear Differential Group	5-150
5-5.6.4	Rear Axle Housing Group	5-155
5-5.6.5	Rear Axle Shafts Group	5-156
5-5.7	Brakes and Wheels	5-158
5-5.7.1	Brake Pedal and Linkage Group	5-158
5-5.7.2	Wheel and Weights Group	5-159
5-5.7.3	Power Brake Booster and Master Cylinder Group	5-160
5-5.7.4	Brake Proportioning Valve Group	5-162
5-5.7.5	Brake Lines Group	5-164
5-5.7.6	Front Brake Caliper Group	5-166
5-5.7.7	Front Brake Disc	5-168
5-5.7.8	Parking Brake Group	5-168
5-5.7.9	Rear Brake and Cylinder Group	5-170
5-5.8	Frame	5-172
5-5.8.1	Frame Assembly and Frame Components Group	5-172
5-5.9	Body	5-175
5-5.9.1	Running Board Group	5-175
5-5.9.2	Body Holddowns Group	5-176

TABLE OF CONTENTS-Continued

Chapter		Page
5-5.9.3	Body Side and Rear Panels Group	5-177
5-5.9.4	Front Fender Group	5-178
5-5.9.5	Door Group	5-179
5-5.9.6	Door Hinges Group	5-180
5-5.9.7	Door Seals Group	5-182
5-5.9.8	Door Latch Group	5-183
5-5.9.9	Door Handles and Lock Rod Group	5-183
5-5.9.10	Locks and Keys Group	5-184
5-5.9.11	Hood and Hinges Group	5-187
5-5.9.12	Hood Latch, Prop Rod and Holddowns Group	5-188
5-5.9.13	Hard Top Enclosure	5-189
5-5.9.14	Windshield Frame Group	5-190
5-5.9.15	Window Seals Group	5-191
5-5.9.16	Glass Group	5-192
5-5.9.17	Grille Group	5-194
5-5.9.18	Outside Mirrors Group	5-196
5-5.9.19	Windshield Washer Group	5-196
5-5.9.20	Windshield Wiper and Motor Group	5-197
5-5.9.21	Horn Group	5-200
5-5.9.22	Headlamps Group	5-200
5-5.9.23	Parking and Front Turn Lamps Group	5-201
5-5.9.24	Harnesses Group	5-202
5-5.9.25	Extendable Hitch Connection Assembly	5-203
5-5.9.26	Chassis Conversion Assembly	5-205
5-5.10	Cab Interior	5-207
5-5.10.1	Front Seat Frame and Pad Group	5-207
5-5.10.2	Front Seat Track Group	5-208
5-5.10.3	Front Seat Upholstery Group	5-209
5-5.10.4	Seat and Shoulder Belts Group	5-210
5-5.10.5	Dome Lamp Group	5-211
5-5.10.6	Headliner and Molding Group	5-212
5-5.10.7	Window Mechanism Group	5-213
5-5.10.8	Door Trim Panels and Arm Rest Group	5-214
5-5.10.9	Inside Rear View Mirror Assembly	5-215
5-5.10.10	Sun Visor Group	5-217
5-5.10.11	Speedometer Cable Group	5-218
5-5.10.12	Heater Hose Group	5-219
5-5.10.13	Heater Group	5-219
5-5.10.14	Heater Controls	5-221
5-5.10.15	Defroster Duct Group	5-222
5-5.10.16	Fresh Air Intake Group	5-223
5-5.10.17	Instrument Panel Group	5-225
5-5.10.18	Instrument Cluster Group	5-226
5-5.10.19	Instruments Including Hourmeter Group	5-228
5-5.10.20	Instrument Panel Switch Group	5-229
5-5.10.21	Miscellaneous Switches Group	5-230
5-5.10.22	Fuse Panel and Parts Group	5-231
5-5.10.23	Directional, Ignition and Hazard Switches Group	5-232
5-5.10.24	Ignition Switch Lock Cylinder Group	5-234
5-5.10.25	Floor Pan, Cowl and Dash Panel Group	5-235

TABLE OF CONTENTS-Continued

Chapter		Page
5-5.10.26	Accelerator Pedal and Linkage Group	5-236
5-5.10.27	Floor Mat Group	5-237
5-5.10.28	Electrical Assembly Installation	5-238
5-5.11	Air System Installation	5-241
5-5.12	Winterization Kit	5-254
5-6	Storage	5-256
5-7	Workmanship and Handling	5-256
5-8	Painting	5-256
6	TABLE OF LIMITS	6-1
6-1	Introduction	6-1
6-2	Specific Torque Values	6-6
6-3	General Torque Values	6-8

LIST OF ILLUSTRATIONS

Number	Title	Page
1-1	Major Components	1-1
2-1	Special Tools	2-1
4-1	Caliper Inspection Port	4-24
4-2	U-Joint Lubrication Point	4-28
4-3	Tire Wear Patterns	4-29
4-4	Tire Rotation	4-30
4-5	Lubrication Chart	4-31
5-1	Flightline Tow Tractor, Model No. 3	5-9
5-2	Air Filter Assembly and Duct Group	5-10
5-3	Positive Crankcase Ventilation System	5-11
5-4	Venturi and Dashpot Assembly Group	5-12
5-5	Intake and Exhaust Manifolds Group	5-14
5-6	Exhaust System	5-15
5-7	Alternator, Starter and Vacuum Pumps Mounting Parts Group	5-16
5-8	Starting Motor Assembly	5-18
5-9	Coil Short Circuit Test	5-20
5-10	Coil Open Circuit Test	5-20
5-11	Coil Insulation Test	5-20
5-12	Shaft-to-Bushing Clearance Check	5-21
5-13	Armature Shaft Alignment Check	5-21
5-14	Commutator Wear Test	5-21
5-15	Commutator Insulation Test	5-21
5-16	Field Coil-to-Coil Continuity Test	5-22
5-17	Coil-to-Frame Continuity Test	5-22
5-18	Brush Holder Insulation Test	5-23
5-19	Brush Wear Test	5-23
5-20	Brush Spring Tension Test	5-23
5-21	Shunt Coil Continuity Test	5-23
5-22	Commutator Insulation Repair	5-23
5-23	Alternator and Vacuum Pump Group	5-24
5-24	Slip Ring Out-of-Round Measurement	5-25
5-25	Slip Ring Wear Measurement	5-26
5-26	Stator Coil Continuity Test	5-26
5-27	Diode Locations	5-27
5-28	Current Flow of Diode Test	5-27
5-29	IC Regulator Test Circuit Diagram	5-27
5-30	Alternator Voltage Regulation Test Circuit Diagram	5-28
5-31	Battery and Mounting Group	5-30
5-32	Heavy Load Test	5-32
5-33	Belts Group	5-33
5-34	Water Pump and Fan Group	5-34
5-35	Radiator, Hose and Coolant Recovery Group	5-36
5-36	Fuel Lines Group	5-38
5-37	Fuel Filter and Fuel Pump Assembly Group	5-39
5-38	Injector Nozzles and Tubes Group	5-42
5-39	Pressure Test Setup	5-42
5-40	Fuel Spray Patterns	5-42
5-41	Oil Cooler and Filter Group	5-44
5-42	Engine Front Cover Group	5-46

LIST OF ILLUSTRATIONS-Continued

Number	Title	Page
5-43	Governor Assembly Installation.....	5-47
5-44	Governor Assembly	5-49
5-45	Injection Pump Assembly	5-51
5-46	Rocker Cover and Cylinder Head Group.....	5-55
5-47	Cylinder Head Torque Sequence	5-57
5-48	Camshaft and Valve Train Group	5-58
5-49	Rocker Arm, Assembled.....	5-60
5-50	Diesel Preheating Group	5-61
5-51	Control Unit Test Connectors	5-62
5-52	Crankshaft Pulley and Flywheel Group.....	5-63
5-53	Engine Oil Pan Group	5-65
5-54	Oil Pump Group	5-66
5-55	Oil Pump Cover-to-Gear Measurement	5-67
5-56	Piston, Connecting Rod and Crankshaft Group.....	5-68
5-57	Piston Measurement.....	5-69
5-58	Ring Clearance Measurement	5-70
5-59	Ring End Gap Measurement	5-70
5-60	Piston Pin Bore Measurement	5-70
5-61	Piston Pin Measurement	5-70
5-62	Main Bearing Journal Measurement	5-71
5-63	Connecting Rod Journal Measurement	5-71
5-64	Crankshaft Bend Measurement	5-71
5-65	Proper Radius Dimension	5-71
5-66	Piston and Ring Markings	5-72
5-67	Piston and Connecting Rod Installation	5-72
5-68	Engine Block Group.....	5-74
5-69	Cylinder Liner Measurement	5-76
5-70	Cylinder Liner Protrusion Measurement	5-76
5-71	Camshaft Bushing Dimension	5-76
5-72	Front Engine Mounts Group	5-78
5-73	Rear Engine Mounts Group	5-79
5-74	Fuel Tank Assembly	5-81
5-75	Shifting With Automatic Transmission on Column.....	5-82
5-76	Throttle Valve Linkage Group	5-83
5-77	Transmission Cooling Lines Group	5-84
5-78	Transmission Assembly and Case Assembly Group	5-86
5-79	Torque Converter Group.....	5-89
5-80	Servo and Valve Body Group.....	5-91
5-81	Governor Control Group	5-94
5-82	Clutches Group.....	5-96
5-83	Gears and Shafts Group	5-100
5-84	Rear Propeller Shaft Group	5-103
5-85	Transfer Case Assembly and Transfer Case Housing Group.....	5-105
5-86	Transfer Case Gears and Shafts	5-108
5-87	Mainshaft Pilot Bearing Removal	5-109
5-88	Front Output Shaft Front Bearing Removal.....	5-109
5-89	Front Output Shaft Rear Bearing Removal	5-109
5-90	Input Gear Bearing Removal	5-110
5-91	Mainshaft Pilot Bearing Installation	5-110
5-92	Input Gear Bearing Installation	5-110

LIST OF ILLUSTRATIONS-Continued

Number	Title	Page
5-93	Front Output Shaft Rear Bearing Installation	5-111
5-94	Front Output Shaft Front Bearing Installation	5-111
5-95	Rear Output Bearing Installation	5-111
5-96	Rear Seal Installation	5-112
5-97	Transfer Case Shift Forks Group	5-113
5-98	Not Used	
5-99	Not Used	
5-100	Not Used	
5-101	Steering Wheel Group	5-114
5-102	Steering Column and Upper Housing Group	5-116
5-103	Metric Steering Shaft Identification	5-118
5-104	Steering Column Lower Housing and Shafts Group	5-120
5-105	Steering Gear Components Group	5-122
5-106	Valve Assembly Components	5-125
5-107	Adjuster Plug Components	5-126
5-108	Valve Body - Wormshaft Installation	5-127
5-109	Seating Valve Body	5-127
5-110	Stub Shaft Position With Gear Centered	5-128
5-111	Pitman Shaft Master Spline Position With Gear Centered	5-129
5-112	Steering Linkage Group	5-130
5-113	Steering Damper Group	5-132
5-114	Power Steering Pump Mounting Group	5-133
5-115	Pump Pulley Removal	5-134
5-116	Pump Pulley Installation	5-134
5-117	Power Steering Hydraulic Pump Assembly	5-135
5-118	Front Shock Absorber Group	5-138
5-119	Front Stabilizer Bar Group	5-139
5-120	Front Spring Group	5-140
5-121	Bushing Replacement Tools - Small Bushing	5-141
5-122	Bushing Replacement Tools - Large Bushing	5-141
5-123	Front Axle Housing Group	5-144
5-124	Rear Shock Absorber Group	5-146
5-125	Rear Spring Group	5-147
5-126	Bushing Replacement Tools - Small Bushing	5-147
5-127	Bushing Replacement Tools - Large Bushing	5-148
5-128	Rear Axle Assembly and Rear Differential Group	5-150
5-129	Spreading Axle Housing	5-151
5-130	Pinion Yoke Removal	5-151
5-131	Installing Pinion Depth Gauge Tools	5-153
5-132	Measuring Gauge Block	5-153
5-133	Rear Axle Housing Group	5-155
5-134	Rear Axle Shafts Group	5-157
5-135	Brake Pedal and Linkage Group	5-158
5-136	Wheel and Weights Group	5-159
5-137	Power Brake Booster and Master Cylinder Group	5-161
5-138	Brake Proportioning Valve Group	5-162
5-139	Brake Lines Group	5-163
5-140	Front Brake Caliper Group	5-165
5-141	Front Brake Disc	5-167
5-142	Checking Lateral Runout	5-167

LIST OF ILLUSTRATIONS-Continued

Number	Title	Page
5-143	Checking Disc Thickness Variation	5-168
5-144	Parking Brake Group	5-169
5-145	Rear Brake and Cylinder Group	5-171
5-146	Frame Assembly and Frame Components Group	5-173
5-147	Running Board Group	5-175
5-148	Body Holddowns Group	5-176
5-149	Body Side and Rear Panels Group	5-177
5-150	Front Fender Group	5-178
5-151	Door Group	5-180
5-152	Door Hinges Group	5-181
5-153	Door Seals Group	5-182
5-154	Door Latch Group	5-184
5-155	Door Handles and Lock Rod Group	5-185
5-156	Locks and Keys Group	5-186
5-157	Hood and Hinges Group	5-187
5-158	Hood Latch, Prop Rod and Holddown Group	5-188
5-159	Hard Top Enclosure	5-189
5-160	Windshield Frame Group	5-190
5-161	Window Seals Group	5-192
5-162	Glass Group	5-193
5-163	Grille Group	5-195
5-164	Outside Mirrors Group	5-196
5-165	Windshield Wiper Group	5-197
5-166	Windshield Wiper and Motor Group	5-198
5-167	Continuity Test for Wiper Switch	5-199
5-168	Horn Group	5-200
5-169	Headlamps Group	5-201
5-170	Parking and Front Turn Lamps Group	5-202
5-171	Harnesses Group	5-203
5-172	Extendable Hitch Connection Assembly	5-204
5-173	Chassis Conversion Assembly	5-206
5-174	Front Seat Frame and Pad Group	5-208
5-175	Front Seat Track Group	5-209
5-176	Front Seat Upholstery Group	5-210
5-177	Seat and Shoulder Belts Group	5-211
5-178	Dome Lamp Group	5-212
5-179	Headliner and Molding Group	5-213
5-180	Window Mechanism Group	5-214
5-181	Door Trim Panels and Arm Rest Group	5-215
5-182	Inside Rear View Mirror Assembly	5-216
5-183	Windshield Mounted Rear View Mirror Bracket Location	5-217
5-184	Sun Visor Group	5-217
5-185	Speedometer Cable Group	5-218
5-186	Heater Hose Group	5-219
5-187	Heater Group	5-220
5-188	Heater Controls	5-222
5-189	Defroster Duct Group	5-223
5-190	Fresh Air Intake Group	5-224
5-191	Instrument Panel Group	5-226
5-192	Instrument Cluster Group	5-227

LIST OF ILLUSTRATIONS-Continued

Number	Title	Page
5-193	Instruments Including Hourmeter Group	5-228
5-194	Instrument Panel Switch Group	5-229
5-195	Miscellaneous Switches Group	5-230
5-196	Fuse Panel and Parts Group	5-232
5-197	Directional, Ignition and Hazard Switches Group	5-233
5-198	Ignition Switch Lock Cylinder Group	5-234
5-199	Floor Pan, Cowl and Dash Panel Group	5-236
5-200	Accelerator Pedal and Linkage Group	5-237
5-201	Floor Mat Group	5-238
5-202	Electrical Assembly	5-239
5-203	Air System Installation	5-242
5-204	Idler Pulley Mounting	5-245
5-205	Air Compressor Installation	5-246
5-206	Air Compressor Assembly	5-249
5-207	Alcohol Injector Assembly	5-251
5-208	Governor Assembly	5-252
5-209	Winterization Kit	5-255
FO-1	Electrical Diagram	FP-1

LIST OF TABLES

Number	Title	Page
2-1	Special Tools and Test Equipment	2-1
4-1	Troubleshooting	4-1
4-2	Scheduled Inspection	4-19
4-3	Engine Component Performance Specifications	4-26
5-1	Consumable Materials	5-1
5-2	Diode Continuity Chart	5-26
5-3	Specific Gravity Chart	5-31
5-4	Test Amperages	5-32
5-5	Glow Relay Assembly Lamp Test Chart	5-62
5-6	Bearing and Journal Regrind Chart	5-72
5-7	Crankshaft Thrust Washer Chart	5-72
5-8	Pinion Variance Chart	5-152
6-1	Table of Limits	6-1
6-2	Specific Torque Values	6-6
6-3	General Torque Values	6-8

SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operations and maintenance.

Personnel must at all times observe all safety regulations. Some equipment and chemicals have inherent hazards that cannot be mechanically safe-guarded. Personnel must perform these functions with caution.

RESUSCITATION: Personnel working with or near highly toxic chemicals should be familiar with modern methods of resuscitation. Such training may be obtained from Base Medical Services.

The word "shall" expresses that a provision is binding. "Should" or "may" express that a provision is non-mandatory. "Will" expresses either a declaration of purpose or simple futurity; i.e., "Power for the starter will be provided by the battery."

The following warnings and cautions appear in the text of this volume and are repeated here for emphasis.

WARNING

Battery fluid contains sulphuric acid. When servicing batteries, wear eye protection (face shield), acid resistant rubber apron and gloves. Keep flames/sparks away from the unit and filter cap openings.

Do not remove radiator draincock or block drain plug when engine has been running for any length of time as burns to personnel may result.

Ethylene glycol is toxic to the eyes, skin and respiratory tract. Eye and skin protection is required. Ethylene glycol should only be used in a well-ventilated area.

Whenever disconnecting battery terminals, always disconnect GROUND (negative) terminal first to avoid sparking and danger of explosion.

When connecting battery terminals, always connect NEGATIVE terminal last to avoid sparking and danger of explosion.

Stay clear of fan and drive belts when engine is running or injury may result.

WARNING

At normal operating temperature, the gauge end of the transmission dipstick will be too hot to hold comfortably. Injury to personnel may result.

Spray booth operations must be approved by local bioenvironmental engineer prior to operating.

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi and goggles are required.

Solvent P-D-680 Type II is toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Good general ventilation is normally adequate.

1,1,1-Trichloroethane is toxic to skin, eyes, and respiratory tract. Avoid prolonged or repeated skin contact. Assure adequate ventilation.

Aircraft cleaning compound (MIL-C-25769) is toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Good general ventilation is normally adequate.

Rust preventative (MIL-C-16173) is flammable and toxic to the skin, eyes and respiratory tract. Keep away from open flame and other ignition sources. Avoid skin and eye contact. Good general ventilation is usually adequate.

Make sure that spray cleaning operations have been evaluated or reviewed by the local bioenvironmental engineer.

Steam or vapor pressure cleaning creates hazardous noise levels and severe burn potential. Eye, skin and hearing protection are required.

Fluorescent penetrant may cause personal injury. Avoid skin contact. In case of skin contact, wash with warm water and soap.

Paint thinner is flammable and toxic to the skin, eyes and respiratory tract. Keep away from open flame or other ignition sources. Avoid skin and eye contact. Good general ventilation is usually adequate.

WARNING

Welding and brazing operations produce heat, toxic fumes, radiation, metal slag and carbon particles. Welding and brazing goggles with the proper tinted lenses, gloves, apron or jacket, and welder's boots are required to protect the welder.

Drilling operations are hazardous to the eyes. Eye protection is required.

Do not work under raised vehicle without first supporting vehicle with safety jack stands.

Avoid breathing fumes generated by soldering or unsoldering as injury to personnel may result.

Isopropyl alcohol is flammable and toxic to the skin, eyes and respiratory tract. Keep away from open flame and other ignition sources. Avoid skin and eye contact. Good general ventilation is normally adequate.

Do not remove cylinder block drain plugs or loosen radiator draincock with system hot and under pressure because serious burns from coolant may occur.

Diesel fuel is combustible and an irritant. Skin and eye protection are required. Good general ventilation is normally adequate. Keep away from open flame and other ignition sources.

The fuel spray from an injector can penetrate the skin. Fuel oil that penetrates the skin can cause a serious infection or death.

Dry ice will cause low temperature burns (-80°C). Temperature resistant gloves are required.

When removing flywheel capscrews, hold flywheel tightly against crankshaft by hand to prevent it slipping off the crankshaft. The flywheel is not dowelled to the crankshaft. Serious injury to personnel or damage to equipment may occur.

When installing hex head flywheel capscrews, hold flywheel firmly by hand to prevent it from slipping off the end of the crankshaft. The flywheel is not dowelled to the crankshaft. Serious injury to personnel or damage to equipment may occur.

When oil pump relief valve is disassembled, removing cotter pin allows springs to expand

WARNING

with considerable force. Always keep valve facing downward and release slowly to avoid injury. Remove spreader tool immediately after removing differential case kit to avoid the possibility of distorting the axle housing.

Support rear propeller shaft assembly with safety jack stands before removing straps or injury to personnel may result.

Do not remove frame rear crossmember without adequate support under the transmission or injury to personnel may result.

When working under chassis, raise suspension and install safety jack stands or injury to personnel may occur.

Do not place fingers in front of the front brake caliper piston in an attempt to catch or protect it. Use only enough air pressure to ease the piston out of the bore. Excessive air pressure can eject the piston with enough force to cause damage or injury.

Remove brake lining residue with a cloth dampened with P-D-680 Type II solvent. Do not use compressed air. Consult local bioengineer for evaluation/review of this operation.

Adhesives are flammable and toxic. Avoid prolonged or repeated skin contact. Use only in well-ventilated areas.

CAUTION

Remove the radiator cap only for testing or when filling the system after service. Removing the cap unnecessarily can cause loss of coolant and allow air to enter the system, which may cause damage by corrosion.

Do not overfill transmission with transmission fluid. Overfilling can cause foaming which can lead to overheating, fluid oxidation or varnish formation. These conditions can cause interference with normal valve, clutch and servo operation. Foaming can also cause fluid to escape from the transmission vent where it may be mistaken for a leak.

Do not spill battery acid on vehicle's painted surfaces. If acid contacts any painted surface, flush immediately with water.

CAUTION

Do not allow supply of brake fluid in master cylinder to become exhausted. Check fluid level frequently while bleeding and refill as required. Do not bleed two wheels at a time, and do not bleed the system with the front calipers or rear drums not in place.

The automatic brake adjuster lever must be disengaged from the adjuster screw before the screw can be rotated or damage to brake components may occur. Use a thin blade screwdriver or section of 1/8 inch welding rod to unseat adjuster lever.

Do not allow brake system master cylinder cover or diaphragm to contact dirt or foreign material.

Handle the battery carefully when removing or replacing it, and avoid tipping it as battery acid is corrosive to painted surfaces.

Do not overfill the transmission with transmission fluid. This can lead to foaming which can lead to overheating, fluid oxidation or varnish formation, all of which can interfere with transmission operation.

Do not overfill wheel hub with grease. Leakage may occur, resulting in contamination of brake linings.

When adjusting front wheel bearings, the spring cup must be installed so the recessed side faces the bearing and the flat side faces the pressure spring. The pressure spring should contact the flat side of the cup only.

Do not clean tires, lubricant seals, rubber hose, or electrical components with cleaning solvent.

Do not use soap or alkalis to clean tank fuel interiors.

When resurfacing exterior surfaces using an abrasive disc, precautions should be taken to guard other parts of the vehicle from abrasive dust. Do not work near exposed parts and openings which would allow the dust to reach working parts.

When removing brushes from starter motor, do not lift brushes by their pigtailed while the brush spring is exerting pressure on the brush.

CAUTION

Do not wash starter motor pinion clutch or drive assembly. If these components are washed, damage may result.

Do not use emery cloth to clean the starter motor commutator. If emery cloth is used, damage to commutator could result.

Inspect the entire circumference of the flywheel gear for damage when teeth of the drive assembly pinion gear are damaged. (Normal wear pattern extends approximately 2 inches along the circumference of the flywheel gear.)

When separating front and rear covers, be careful to avoid damage to rear cover oil seal.

When disconnecting alternator stator assembly from diode assembly, use soldering gun with a high heating capacity to melt solder quickly, and use suitable pliers to group leads immediately below soldering iron or heat may damage diode assembly.

Do not clean alternator rotor with degreasing solvent or damage to rotor may result.

When using abrasive to clean alternator rotor, support the rotor while spinning to clean slip rings evenly. Cleaning slip rings without support may result in flat spots on slip rings which may cause brush noise and premature brush wear.

Make sure vent caps are tightly secured to battery before cleaning to avoid contaminating electrolyte with cleaning solution.

When removing nozzle and holder assemblies, cover injection pump with clean rag to prevent entry of dirt which may cause damage to injection pump.

When checking oil cooler element, do not use compressed air at a pressure higher than 140 psi or damage to oil cooler element may result.

When removing timing gear case, do not scratch or nick the sealing edge of the oil seal.

Perform injection pump disassembly procedure with care. Lay out parts on bench in proper order. Place serviceable plungers in proper plunger barrels and immerse in solvent.

CAUTION

Do not allow cleaning fluid to get into injection pump delivery valve and other internal pump parts.

Do not apply excessive pressure when installing cylinder head chambers. Chambers must be even with cylinder head.

Do not use force to remove rocker brackets. Warm entire assembly to 158°F to free up brackets.

Do not apply heat to straighten rocker shaft.

If any part is replaced due to chipped teeth, replace mating part as it may have invisible fractures.

Cleanliness during disassembly and assembly is necessary to avoid a further malfunction after assembly. Before removing any of the transmission subassemblies, plug all openings and thoroughly clean the transmission exterior. Steam cleaning equipment is preferable for this purpose. During disassembly, clean all parts in a suitable solvent and dry each part using compressed air. Do not use cloth or paper towels to dry any parts after cleaning, use compressed air only.

Do not use any type of caustic cleaning solution when cleaning servo and valve body group components of the transmission as damage may result.

Do not clamp any part of the transmission reaction-shaft support assembly in a vise.

When disassembling the transfer case, use a rawhide or plastic mallet when tapping the retainer. Do not attempt to use a pry bar to remove retainer or damage to retainer or case may result.

When disassembling the transfer case, do not attempt to wedge case halves apart at any point on mating surfaces or damage to surface may result.

When assembling the transfer case, be sure front output shaft rear thrust bearing assembly is seated in the rear case before connecting case halves or damage to thrust bearings, gears and shaft may result.

When installing the transfer case, be sure it is flush against the transmission before tightening attaching bolts. Severe damage to transfer

CAUTION

case will result if the attaching bolts are tightened while transfer case is cocked or in a bind.

The steering shaft is free in the steering column after retainer ring is removed. Do not allow the shaft to fall out of the column.

Use only the specified screws, bolts, and nuts when servicing the steering column, and tighten all fasteners to recommended torque values only to maintain the energy-absorbing (compressing) action of the column. Incorrect length screws or bolts can prevent the column from compressing under impact. The bolts and nuts that attach the column mounting bracket to the column and instrument panel must also be tightened to the proper torque so that the bracket will break away under impact.

Identify the steering shaft nut thread type before using the compressor tool. If the shaft has American threads, use the compressor tool as is. However, if the shaft has metric threads, replace the compressor tool forcing screw with metric forcing screw J-22653-4 before using the tool.

Some steering shafts have metric size steering wheel nut threads. If a replacement nut is being installed, identify the shaft thread type before installation. Metric shafts have an identifying groove in the steering wheel locating splines. American thread shafts do not have this groove.

Do not attempt to separate the lower shaft and steering column at the beginning of the disassembly procedure. If separated, the plastic connector injected into the lower shaft could be damaged.

To avoid damaging the steering column mounting bracket breakaway capsules, store the bracket in a safe place until service operations are completed.

When unseating the rack piston end plug from the steering gear, do not rotate the stub shaft any farther than necessary or the ball bearings will drop out of the rack piston circuits. This causes the rack piston and pitman shaft sector teeth to disengage, preventing removal. If disengagement should occur, remove the side cover and pitman shaft and reengage the teeth.

CAUTION

Do not attempt to remove the rack piston end plug from the steering gear until it has been unseated as the plug could break.

When installing double lipseal in steering gear, do not bottom seal against housing counterbore.

When assembling the steering gear, do not allow the stub shaft to disengage from the valve body pin. If disengagement occurs, the spool valve will extend too far into the valve body, allowing the preformed packing to expand into the valve body grooves and preventing valve withdrawal.

The power steering gear and pump form a closed system. Contaminants or foreign material must not be allowed to enter the system at any point. If the pump (or gear) is contaminated or damaged so as to produce debris, both the pump and gear must be disassembled, cleaned and serviced.

Inspect the exposed surface of the power steering pump shaft. Remove all traces of corrosion or nicks and scratches before disassembling the pump. This will prevent damage to the pump occurring during disassembly which might necessitate replacement of the entire pump body. Do not overtighten vise as pump body could be distorted.

Do not allow dirt to enter the power steering pump during assembly. Clean and lubricate all parts and perform assembly on a clean work surface.

When assembling power steering components, do not overspread retaining ring. Open it only enough to install it.

When assembling the power steering pump, be careful to avoid displacing or damaging any of the seals. Use a wood or plastic tool to keep the preformed packing in its groove when installing the reservoir.

Some power steering pumps have metric threaded assembly fittings which are designed for use with metric hose fittings that use an O-ring seal. If the fitting is to be replaced, be sure to install the correct threadtype fitting.

CAUTION

When removing the front spring bushing, press only on metal outer sleeve or damage to bushing may result.

Remove spreader tool immediately after removing differential case kit to avoid the possibility of distorting the axle housing.

When measuring differential pinion depth to avoid false reading, do not allow the gauge block anvil to contact the pinion gear at any point.

The same amount of shim thickness added or subtracted from one side of differential bearing shim packs must be added or subtracted on the opposite side.

Clean the brake system master cylinder assembly with brake fluid only. Never use solvents containing mineral oil such as gasoline, kerosene, alcohol or carbon tetrachloride. Mineral oil is very harmful to the rubber piston cups and seals.

Do not use wire to open a clogged port in the master cylinder assembly as wire may create burrs in the port and cylinder bore.

Remove brake caliper repair kit seals using a wooden or plastic tool as a metal tool could score the piston bore.

Do not attempt to clean or polish brake caliper mounting bolts with abrasives as the protective plating will be removed.

When overhauling the rear brakes, do not attempt to reduce deep ridges or grooves in the plate by grinding or improper shoe-to-drum contact may result.

When removing hard top enclosure, avoid damaging foam seals installed between the panel assembly and the rear body panel.

When installing hard top enclosure, avoid damaging foam seals installed between the panel assembly and the rear body panel.

Do not touch surfaces to which accelerator has been applied or an imperfect bond could result.

INTRODUCTION

PURPOSE.

This publication presents the overhaul instructions for the Flightline Tow Tractor, Model No. 3. This vehicle is supplied by PSI Mobile Products, Inc., Mt. Clemens, Michigan 48403.

SCOPE.

This manual provides a general description of the flightline tow tractor and detailed descriptions of its major components and systems. Instructions are given for preparation of the vehicle for use and for inspection, lubrication and maintenance of its major components and systems. This manual provides both general overhaul instructions and specific procedures for overhauling all vehicle components.

Chapter 1 - General Information. Descriptive information regarding the vehicle and its major components, including explanations of the functional relationships of the major components, and theory of operation of the components and major systems.

Chapter 2 - Special Tools and Test Equipment. This chapter lists and illustrates (by reference) all special

tools and test equipment which must be employed during performance of the procedures contained within this manual.

Chapter 3 - Preparation For Use. Instructions for preparing the vehicle for transport and for use after transport.

Chapter 4 - In-Use Inspection, Maintenance and Lubrication. Instructions for periodic inspection, servicing, adjustment, and lubrication of the vehicle and accessories.

Chapter 5 - Overhaul Procedures. Covers overhaul procedures for the vehicle and accessories including removal, disassembly, cleaning, inspection, repair, replacement, reassembly, and installation.

RELATED TECHNICAL MANUALS.

The Air Force manuals related to these overhaul instructions are listed below:

- TO 36A10-3-29-31 Operator and Maintenance Manual for the Flightline Tow Tractor, Model No. 3
- TO 36A10-3-29-34 Illustrated Parts Breakdown.

Chapter 1

GENERAL INFORMATION

1-1 PURPOSE OF EQUIPMENT.

The Flightline Tow Factors Model No. 3 (herein referred to as the vehicle), is designed for use in general towing operations in a flightline environment. It is designed for towing trailers and other wheeled loads. Pintle hooks in the front and rear of the vehicle are available for the attachment of loads.

1-2 GENERAL DESCRIPTION.

The vehicle is designed for high maneuverability, ease of operation and maximum flexibility in flightline towing operations. The vehicle is built in accordance with conventional design for automotive-type vehicles and is equipped with a diesel engine, three-speed automatic transmission, pneumatic tires and hydraulic brakes. See figure 1-1 for identification of major components. Power is provided by the six cylinder diesel engine which drives the rear axle through the transfer case, torque converter and transmission.

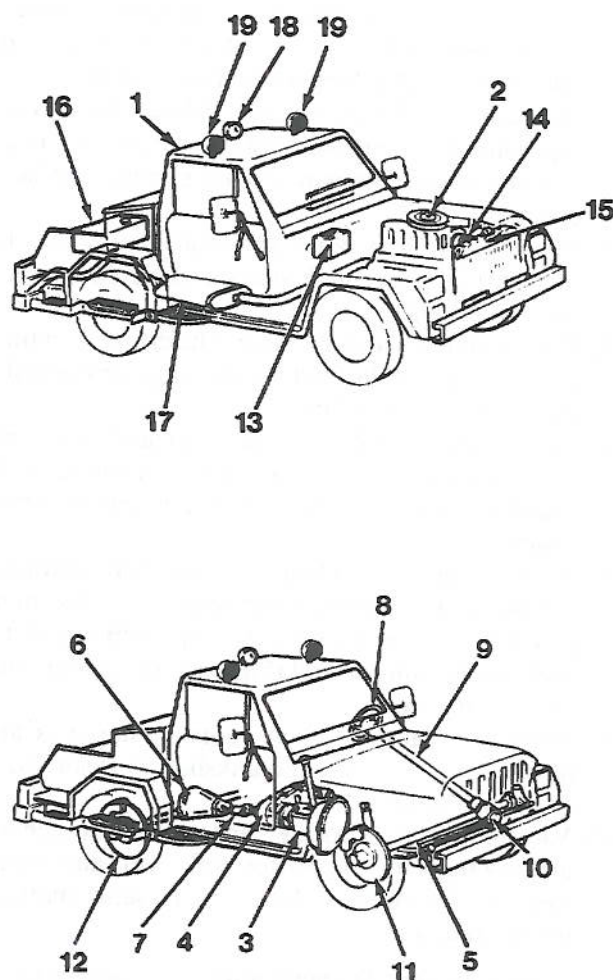
The operator's compartment seats three, and all controls and instruments necessary for vehicle operation are conveniently arranged in the cab. All instruments and controls are generally similar to the controls for any conventional piece of automotive equipment. The vehicle also has four pintle hooks, including one in front, and an extendable hitch assembly in the rear. An exterior tool box, a work light and ballast mounts are also located on the rear of the vehicle.

1-3 DETAILED DESCRIPTION.

The following items represent the major components and systems contained on this vehicle and are described here in detail.

1-3.1 Frame. The frame is the foundation and structural center of the vehicle. In addition to carrying the load, it mounts and supports the power unit while maintaining correct relationship and alignment of the power train. This relationship assures normal functioning of the units and freedom from excessive wear, stress and strain. The frame is constructed of heavy-channel-steel side rails and crossmembers. The crossmembers maintain the proper positions of the side rails in direct relationship to each other, providing maximum resistance to torsional twists and strains.

1-3.2 Engine. The engine is a four-cycle, six-cylinder, in-line swirl combustion chamber diesel engine. Listed below are several features which



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- | | |
|--------------------|-----------------------|
| 1. Cab | 10. Steering Gear |
| 2. Engine | 11. Front Disc Brakes |
| 3. Transmission | 12. Rear Drum Brakes |
| 4. Transfer Case | 13. Battery |
| 5. Front Axle | 14. Alternator |
| 6. Rear Axle | 15. Radiator |
| 7. Propeller Shaft | 16. Fuel Tank |
| 8. Steering Wheel | 17. Muffler |
| 9. Steering Column | 18. Work Light |
| | 19. Warning Lights |

Figure 1-1. Major Components

contribute to its economy, durability and quiet operation.

- (1) **Spherical-Swirl Combustion Chamber.** A spherical-swirl combustion chamber is connected by an elliptical opening to the main combustion chamber. Compressed air in the cylinder is introduced into the swirl chamber where fuel is sprayed at a right angle to the air stream. This contributes to rapid and effective combustion of the air/fuel mixture and to quiet operation, easy starting and fuel economy.
- (2) **Glow Plugs.** Glow plugs are installed at each cylinder to promote quick starts under cold operating conditions.
- (3) **Replaceable Cylinder Liners.** The dry-type cylinder liners are replaceable, improving serviceability and long engine life.
- (4) **Lubrication.** A full-flow oil filter and large oil cooler extend intervals between oil changes and maintain proper oil temperature; oil jets cool the pistons.
- (5) **Piston Rings.** The piston rings are hard chromium plated to improve wear resistance. The first piston ring is a full-keystone type which resists high temperature. Hood ring carriers are cast into the piston groove.
- (6) **Vibration Dampening.** A rubber damper is attached to the end of the crankshaft to absorb torsional vibration.
- (7) **Vacuum Pump.** A rotary-vane type pump generates vacuum for the power brake unit and other systems. The pump is driven on the same shaft as the alternator.

1-3.3 Transmission. The automotive transmission used in the vehicle is a fully automatic, three-speed, hydraulically operated unit with a compound planetary gear system. A three-element torque converter is used for all applications. A manually operated gearshift linkage is used to select the desired gear range. The transmission case and converter housing consists of a one-piece aluminum casting. An aluminum adapter housing is used to connect the transmission to the transfer case. The shift points on this model vary with throttle opening. Listed below are transmission components and related assemblies.

- (1) **Torque Converter.** The three-element torque converter consists of a front cover, impeller, turbine, stator and stator over-running clutch. The impeller is the driving member and is connected to the engine crankshaft through the front cover which is welded to the impeller. The turbine is the driv-

en member and is splined to the transmission input shaft. The stator is the reaction member and is splined to the transmission reaction shaft.

- (2) **Clutch-Band-Gear System.** The transmission contains multiple disc clutches, two bands and actuating servos, an over-running clutch and two planetary gear sets, all of which combine to provide one reverse and three forward gear ranges. The planetary gear sets are connected by a common sun gear. The sun gear is interconnected to the multiple disc clutches through the driving shell which is splined to the sun gear and front clutch retainer.
- (3) **Hydraulic System.** The hydraulic system consists of a single oil pump, a valve body containing the pressure-regulating shift control valves, a governor valve assembly, two bands and actuating servos and an accumulator.

1-3.4 Brakes. The vehicle is equipped with single-piston, low-drag, floating caliper front disc brakes. Listed below are features of the brake system.

- (1) The brake caliper slides on pivot bolts installed in the support shield and bracket assembly.
- (2) The rear drum brakes have linkage-operated adjusters.
- (3) A dual-reservoir master cylinder that provides separate hydraulic systems for the front and rear brake is used.
- (4) A three-function combination valve is used. The valve consists of a one-piece housing containing a front brake metering valve, pressure differential warning valve and rear brake proportioning valve.
- (5) The power brake unit is a 9-1/2 inch single diaphragm power unit.
- (6) The vacuum pump is mounted on the rear cover of the alternator. It produces vacuum for the power brakes and other components.

1-3.5 Steering System. The power steering system forms a closed system consisting of a power steering gear, a hydraulic pump and interconnecting hoses. The system fluid supply is contained in a reservoir mounted on the pump. Fluid from the pump is supplied to the gear through the interconnecting pressure and return hoses. The pump is operated by a drive belt mounted on pulleys attached to the pump shaft and engine crankshaft.

The vehicle uses a steering gear with a variable ratio gear that has a 16:1 ratio on center and a 13:1 ratio at full lock. A vane-type power steering pump with a combination flow control/relief valve is used.

The valve is calibrated to open at 1500 psi. The power steering gear is designed to operate manually if a system malfunction should ever occur. This feature provides the driver with continued steering control of the vehicle. In this condition, the gear operates like a manual steering gear; hydraulic fluid is bypassed through the gear valve body to allow manual operation.

1-3.6 Electrical System. The vehicle is equipped with a 12-volt battery containing low-antimony/lead compound plates. In addition to helping reduce overall vehicle weight, they require less frequent electrolyte inspections, have a decreased self-discharge rate from local action and have a longer shelf life. Electrolyte level inspections are required only at the beginning of each winter season and every 15,000 miles.

The negative ground alternator used has an internally mounted integrated circuit voltage regulator that is sealed in plastic. The voltage regulator is attached to the brush holder assembly. A rotor assembly is supported by ball bearings in the front and rear covers. The rotor shaft extends through the rear cover to drive an externally mounted vacuum pump that is attached to the rear cover. The alternator is a rotating-field, three-phase AC alternator with 60-ampere output.

Refer to figure FO-1, Wiring Diagram, for wiring reference. The vehicle has a main wiring harness connector located at the left upper corner of the dash panel. This connector is made up of the engine forward lamp harness at the engine compartment side and the fuse and instrument panel harness at the passenger compartment side.

The connector can be removed from the dash panel by removing the center bolt from the engine compartment side and the two attaching screws from the driver's side. Be careful not to bend the male spade terminals when removing or installing the connector. The center of the connector is filled with a non-conductive grease to prevent corrosion of the terminals.

The wiring for the lighting system is color coded for easy tracing. The switch for the lighting system has a 24-ampere circuit breaker. The upper and lower headlamp beams are controlled by a foot switch located on the floorboard.

The vehicle is equipped with a rectangular, single headlamp system. Both lamps contain two elements: one low beam and one high beam.

The vehicle also contains backup lamps, a dome lamp, instrument cluster lamps, parking and directional lamps, rear directional lamps, stop lamps, taillamps and a four-way emergency flasher.

Fuses protecting the vehicle electrical system are located in the fuse panel and bulkhead connector, located on the passenger compartment side of the dash panel. They are attached to the main harness connector.

The horn system includes horn, horn relay, steering column wiring harness and horn contact.

1-3.7 Cooling System. The vehicle's cooling system regulates engine operating temperature by allowing the engine to reach normal operating temperature as soon as possible, maintaining normal operating temperature and preventing engine overheating. The cooling system also provides a means of heating the passenger compartment and cooling the automatic transmission fluid. The cooling system is pressurized and uses a centrifugal water pump to circulate coolant through the system.

1-3.8 Fuel System. In the vehicle's fuel system, fuel is drawn from the tank by the feed pump and delivered through the water separator and fuel filter to the injection pump. The injection pump feeds fuel through the nozzles to the combustion chambers. Listed below are features of the fuel system.

- (1) The filter overflow valve maintains specified fuel pressure and prevents excessive fuel temperature.
- (2) Any excess fuel to the nozzles or to the filter overflow valve bypasses the nozzles or valves and returns to the fuel tank.
- (3) A mechanical governor controls engine speed.

1-3.9 Exhaust System. The vehicle's exhaust system consists of exhaust manifold, front exhaust pipe, muffler, tailpipe and spark arrestor.

The exhaust system must be properly aligned to prevent stress, leakage and chassis contact. If the system contacts any body panel, it may amplify objectionable noise.

1-3.10 Air System. The air system is designed to produce positive air pressure between 100-125 psi, using a belt-driven air compressor. The air compressor mounts to a bracket assembly attached to the engine block. Power to the air compressor is provided by a belt and pulley from the crankshaft. An idler pulley mounted to the water pump assembly is used to direct and apply belt tension to the pulley attached to the air compressor. Two air tanks located under the vehicle hold equal pressure supplied by the air compressor. Maximum air pressure is regulated by an adjustable air governor assembly, which is designed to unload air pressure from the compressor when pressure exceeds the adjustable limit of 100 to 125 psi. Air pressure is indicated on an air pressure gauge mounted under the dashboard. If pressure drops below a preset limit, a buzzer sounds, alerting an operator of a drop in air pressure.

The air compressor receives air through an air filter. Compressed air is supplied to one side of the governor and to the alcohol injector. The alcohol injector injects an alcohol vapor into the pressurized air. This prohibits air from freezing which can cause component failure.

Air is supplied to the left-hand air tank from the alcohol injector. Two outlet pressure hoses are connected to the left-hand air tank. One hose connects to the other side of the air governor, and the other hose connects to the right-hand air tank. Heater and drain valve assem-

blies are attached to each tank. The heater is activated by the HEATER ON/OFF switch located on the dashboard. The drain valve is removed to drain fluids from both tanks.

Three outlet hoses are attached to the right-hand air tank. Two of the three hoses connect to the right front and rear shutoff valves and gladhand couplings. The third outlet hose connects to a tee and supplies air to the air pressure gauge and the input side of the air valve, located under the dashboard. Air proceeds through the output side of the air valve and is supplied through the left front and rear gladhand couplings.

1-3.11 Winterization System. The winterization system is used to prevent coolant, oil, and battery from freezing during extreme cold weather conditions. The system receives power from an external 115 VAC power source. External power is plugged into a male outlet mounted to the front of the vehicle. Each component receives power through a fused junction box rated at 20 amperes.

Thermostats control power to the cooler and oil heaters. When temperature exceeds the preset limit of each thermostat, it opens preventing the heater(s) from operating. The battery warmer contains no thermostat and remains on constantly as long as power is applied to the system.

Chapter 2

SPECIAL TOOLS AND TEST EQUIPMENT

2-1. GENERAL.

Certain tools and test equipment are required to perform overhaul and test procedures outlined in Chapters 4 and 5. Table 2-1 lists special tools and test equipment by part numbers and by index numbers (referring to

figure 2-1), describes their functions and indicates the area of the manual in which they are used. Figure 2-1 contains illustrations of all special tools and equipment listed in Table 2-1.

Table 2-1. Special Tools and Test Equipment

Tool Equipment No.	Figure No.	Nomenclature	Use And Application (Paragraph)
J-2619-01	5-85, 5-87	Slide Hammer	5-5.3.3a
J-3837-2	2-1 (14)	Pilot Studs Tool	5-5.2.9d
J-4245	2-1 (40)	Snap Ring Pliers	5-5.4.4b,e
J-5223-4	2-1 (28)	Gauge Arbor	5-5.6.3d
J-5223-20	2-1 (25)	Gauge Block	5-5.6.3d
J-5223-24	2-1 (23)	Clamps	5-5.6.3d
J-5223-25	2-1 (27)	Discs	5-5.6.3d
J-5223-27	2-1 (26)	Gauge Block Plunger	5-5.6.3d
J-5223-29	2-1 (24)	Bolt	5-5.6.3d
J-5864	2-1 (21)	Dial Indicator Support Rod	5-5.2.9a
J-6221	2-1 (42)	Remover/Installer	5-5.4.4b,e
J-6585-1	2-1 (49)	Slide Hammer Tool	5-5.2.9a
J-6632	2-1 (44)	Puller Tool	5-5.4.4a
J-6893	N.I.	Lockring Remover	4-4.15b
J-7004-3	2-1 (50)	Slide Hammer Bolts Tool	5-5.7.7a,d
J-7079-2	2-1 (51)	Driver Handle	5-5.2.8a
J-7624	2-1 (45)	Spanner Wrench	5-5.2.9a
J-7818	2-1 (5)	Installer	5-5.6.3d
J-8001	2-1 (20)	Dial Indicator	5-5.4.4e
J-8092	2-1 (52)	Driver Handle (Figs. 5-86, 5-88)	5-5.3.3b
J-8614-01	2-1 (7)	Remover Tool	5-5.2.8d
J-8614-02,03	2-1 (33)	Remover Tools	5-5.2.9a,d
J-8842	2-1 (46)	Seal Remover	5-5.4.4b,e
J-21104-01	2-1 (53)	Weatherstrip Remover	5-5.3.3a
J-21177-01	2-1 (34)	Brakeshoe-to-Drum Clearance Gauge	5-5.6.3a
J-21232	2-1 (38)	Puller Tool	5-5.4.8b
J-21232-01	2-1 (19)	Steering Wheel Puller	5-5.9.7a
J-21551	2-1 (43)	Remover/Installer	4-4.5b
			5-5.4.1a
			5-5.10.24
			5-5.4.4b

N.I. = NOT ILLUSTRATED

Table 2-1. Special Tools and Test Equipment-Continued

Tool Equipment No.	Figure No.	Nomenclature	Use And Application (Paragraph)
J-21552	2-1 (41)	Arbor Tool	5-5.4.4b,e
J-7539-01A			
J-21553	2-1 (40)	Installer	5-5.4.4e
J-22904	2-1 (35)	Installer	5-5.7.6d
J-23600	2-1 (8)	Tension Gauge	4-4.3
			5-5.1.10d
J-23653	2-1 (37)	Compressor Tool	5-5.4.2a,d
		-	5-5.10.24a
J-23653-4	2-1 (54)	Metric Forcing Screw	5-5.4.2a
J-23709	2-1 (36)	Metering Valve Tool	4-4.5c
J-24026	2-1 (18)	Holding Fixture	5-5.2.4b,e
			5-5.2.6a,d
			5-5.2.8a
			5-5.2.9a,d
J-24037	2-1 (16)	Bushing Removal Tool	5-5.2.9a
J-24038	2-1 (11)	Bushing Installer Tool	5-5.2.9d
J-24039	2-1 (10)	Bushing Remover/Installer Tool	5-5.2.8d
J-24040	2-1 (12)	Bushing Installer Tool	5-5.2.8d
J-24041	2-1 (17)	Bushing Removal Tool	5-5.2.8a
J-24042	2-1 (15)	Compressor Tool	5-5.2.8a,d
J-24043	2-1 (9)	Support Stand	5-5.2.6a
J-24055	2-1 (13)	Remover/Installer Tool	5-5.2.9a
J-24385-01	2-1 (29)	Spreader Tool	5-5.6.3a
J-24433	2-1 (22)	Installer Sleeve	5-5.6.3d
J-25033	5-114	Installer	5-5.4.7d
			5-5.4.8e
J-25034	5-113	Remover	5-5.4.7a
			5-5.4.8b
J-25070	2-1 (47)	Electric Heat Gun	5-5.10.9d
J-25101	2-1 (32)	Installer	5-5.6.3d
J-25122	N.I.	Driver Handle	5-5.6.3d
J-25157	N.I.	Installer	5-5.6.3d
J-25194	N.I.	Locknut Installer	5-5.4.4e
J-25359-C	2-1 (48)	Torx Bit Tool	5-5.9.9a,d
			5-5.9.6a,d
			5-5.9.14a,d
			5-5.10.4a,d
			5-5.10.8a,d
J-26941	5-87	Remover Tool	5-5.3.3b
J-28648	2-1 (31)	Installer	5-5.6.3d
J-29162	2-1 (3)	Installer	5-5.3.3b
J-29184A			
J-29163	2-1 (1)	Installer	5-5.3.3b
J-29167	2-1 (6)	Installer	5-5.3.3b
J-29168	5-86	Drive Handle	5-5.3.3b

A = ALTERNATE

N.I. = NOT ILLUSTRATED

Table 2-1. Special Tools and Test Equipment-Continued

Tool Equipment No.	Figure No.	Nomenclature	Use And Application (Paragraph)
J-29169	2-1 (4)	Installer	5-5.3.3b
J-29170	5-88	Remover	5-5.3.3b
J-29174	2-1 (2)	Installer	5-5.3.3b
J-29369-1	5-85	Remover	5-5.3.3a
J-29721	2-1 (30)	Removal Tool	5-5.6.3d
J-57914-010	2-1 (55)	Socket Wrench	5-5.1.21b
J-57916-432	N.I.	Special Wrench	5-5.1.21b
J-57920-032	2-1 (56)	Delivery Valve Extractor Tool	5-5.1.21b
J-57921-012	2-1 (58)	Tappet Insert Tool	5-5.1.21b
J-57921-210	2-1 (57)	Tappet Holder Tool	5-5.1.21b
J-57921-412	2-1 (59)	Plunger Insert Tool	5-5.1.21b
J-57926-511	2-1 (60)	Extractor Tool	5-5.1.21b
J-57931-210	2-1 (62)	Tappet Holder Tool	5-5.1.21b
J-57931-612	2-1 (61)	Tappet Clamps	5-5.1.21b
9969Z7000	2-1 (63)	Removal Tool	5-5.1.22b
9969Z7001	2-1 (64)	Removal Tool	5-5.1.22b
99590Z7000	N.I.	Installer	5-5.1.29e
99600Z7000	2-1 (65)	Puller Tool	5-5.1.29b,e
00624Z7000	2-1 (66)	Split Collar Tool	5-5.1.23b,e
99665Z7000	2-1 (67)	Valve Seat Tool	5-5.1.22e
99665Z7001	2-1 (68)	Valve Seat Tool	5-5.1.22e
99674Z7000	2-1 (69)	Valve Stem Seal Replacer Tool	5-5.1.23e
99724Z5000	2-1 (70)	Removal Tool	5-5.1.16a,e

A = ALTERNATE

N.I. = NOT ILLUSTRATED

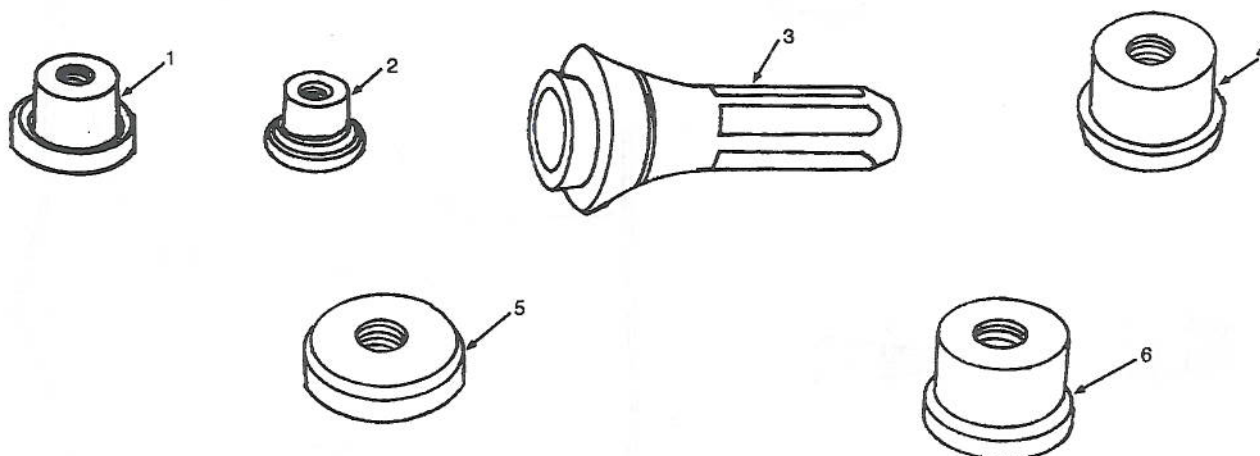


Figure 2-1. Special Tools (Sheet 1 of 7)

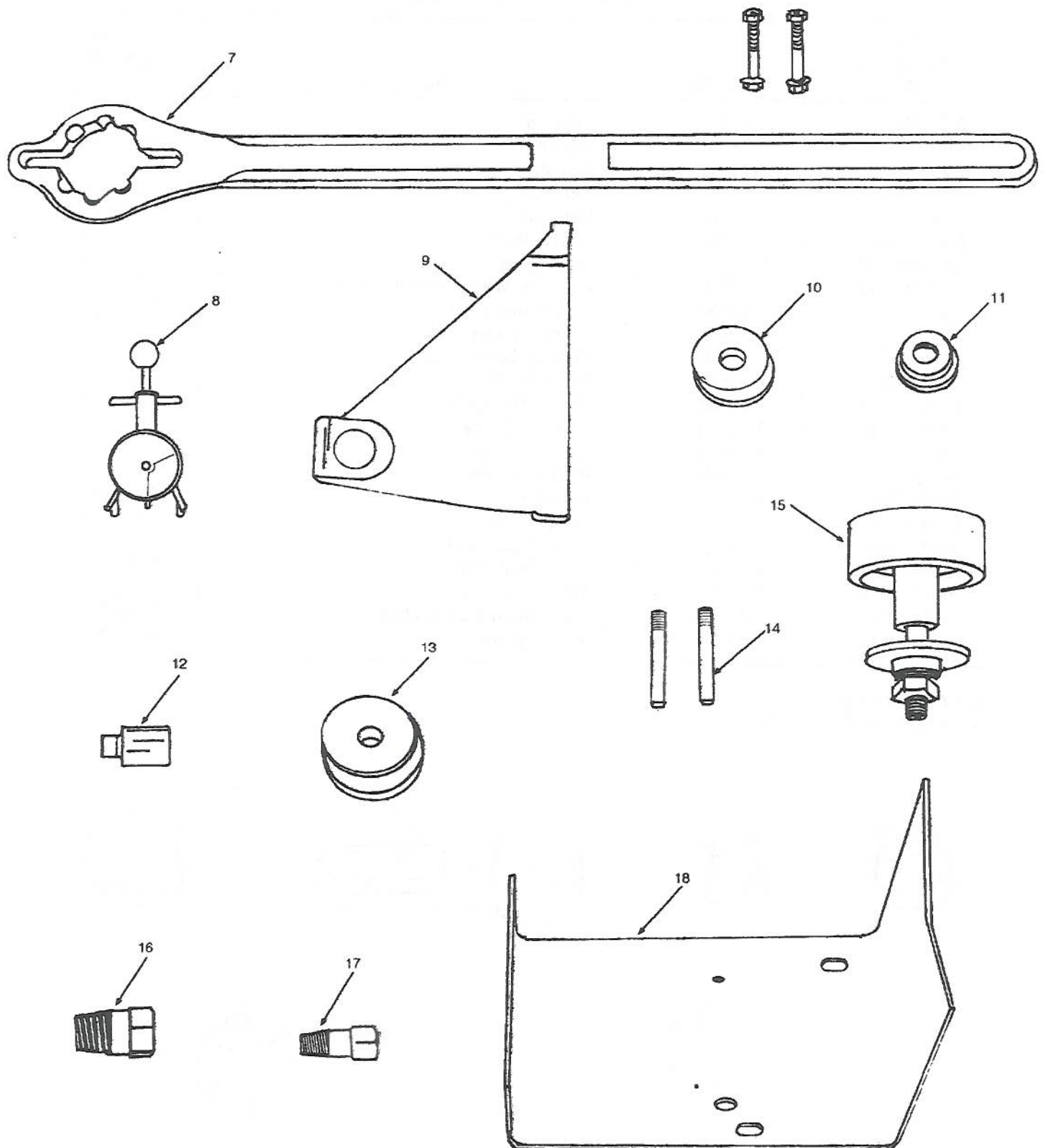


Figure 2-1. Special Tools (Sheet 2 of 7)

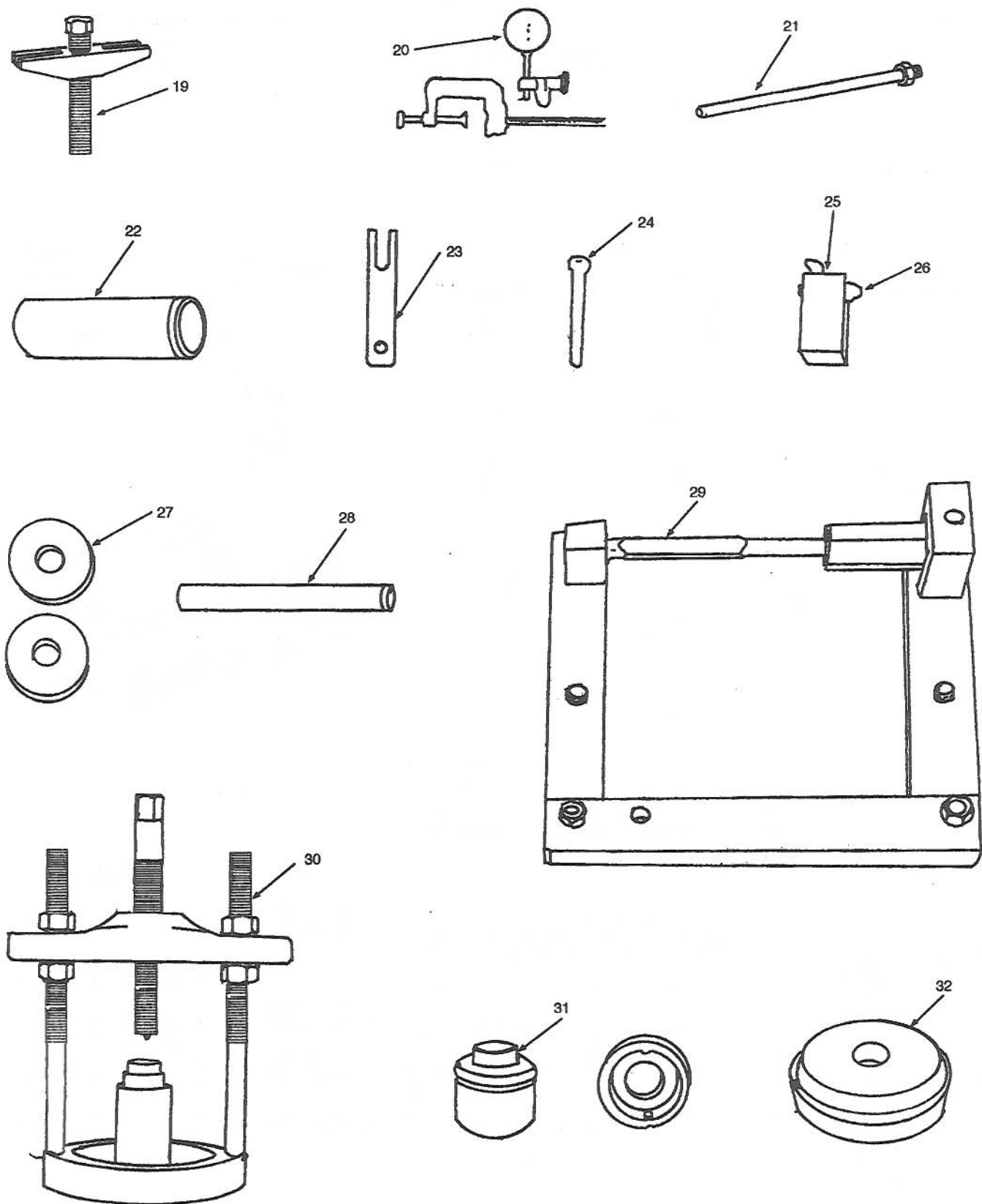


Figure 2-1. Special Tools (Sheet 3 of 7)

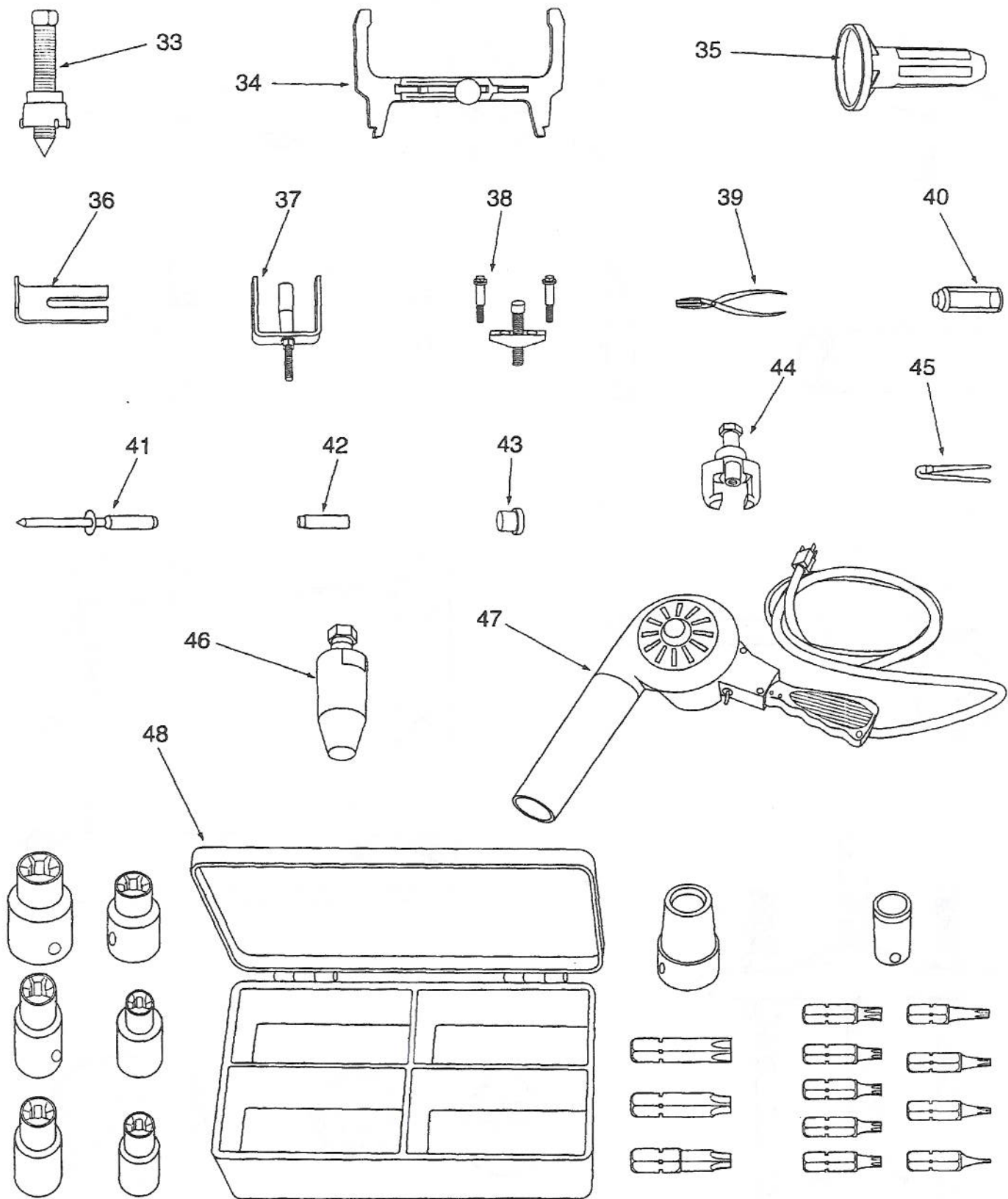


Figure 2-1. Special Tools (Sheet 4 of 7)

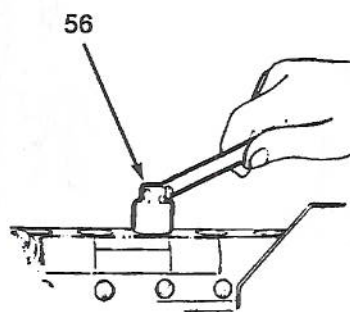
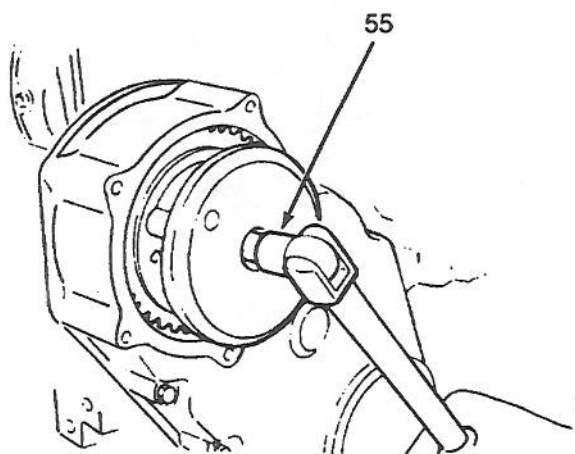
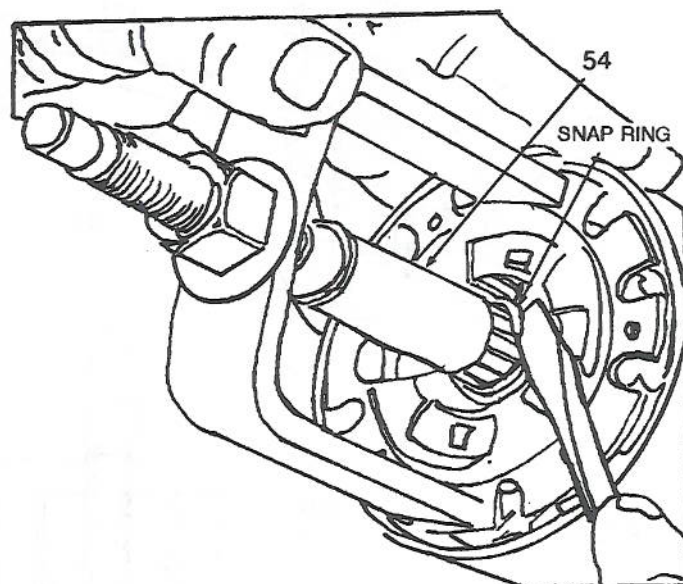
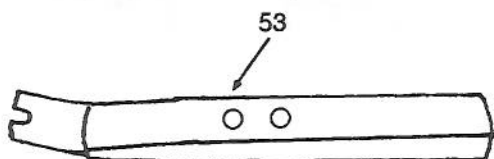
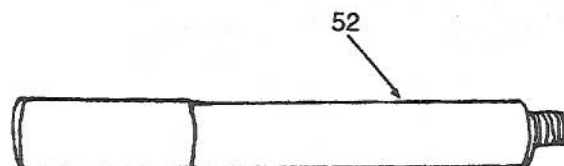
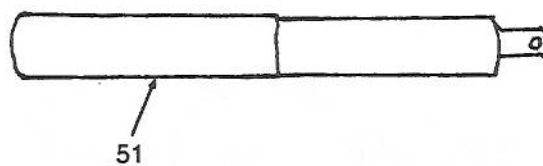
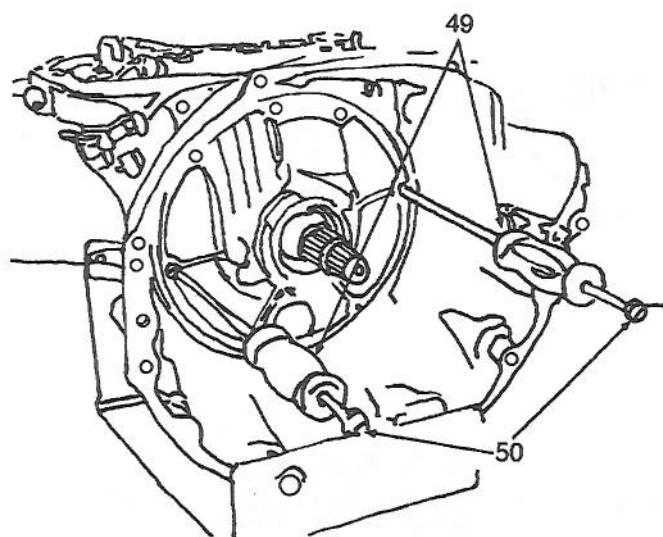


Figure 2-1. Special Tools (Sheet 5 of 7)

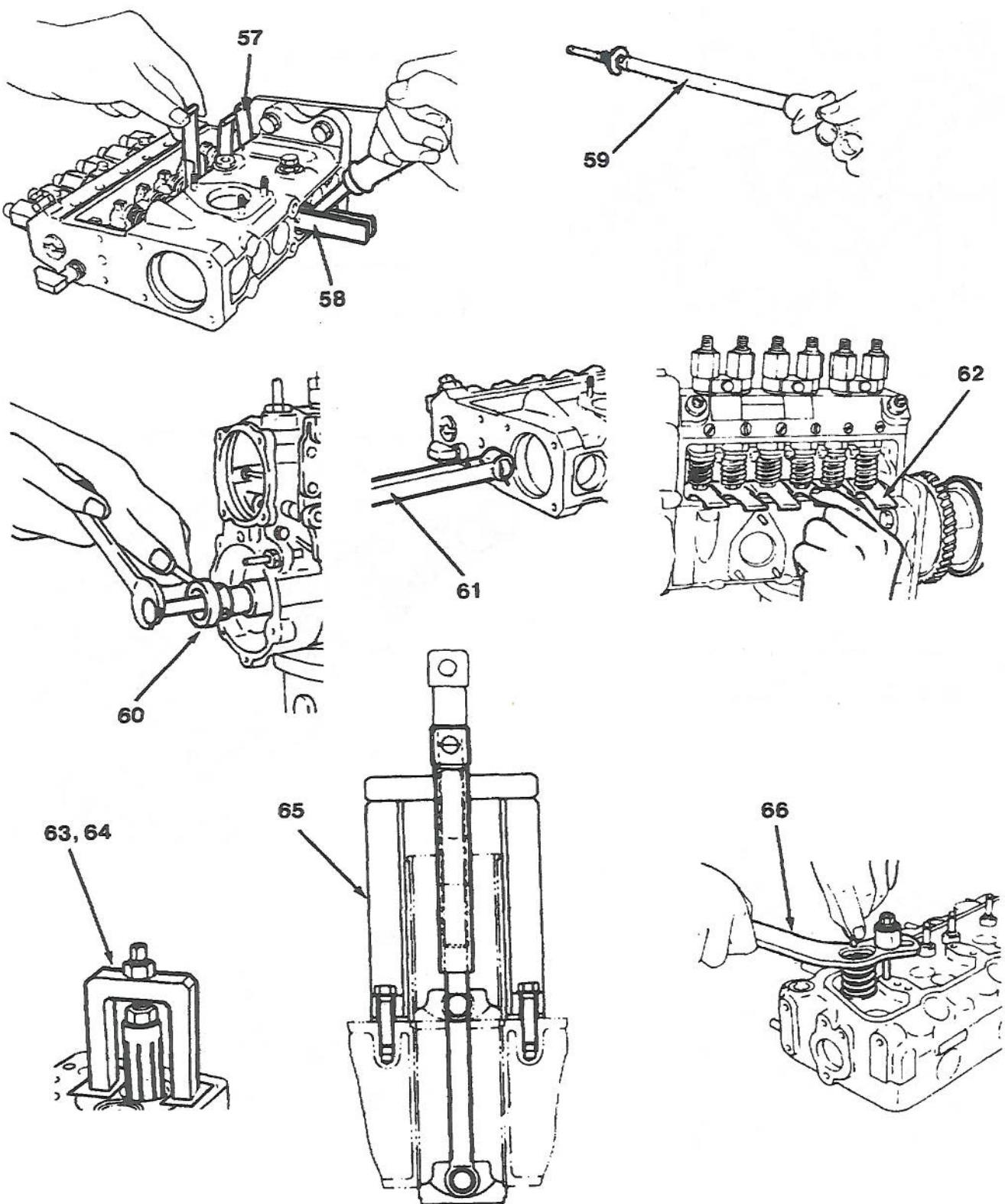


Figure 2-1. Special Tools (Sheet 6 of 7)

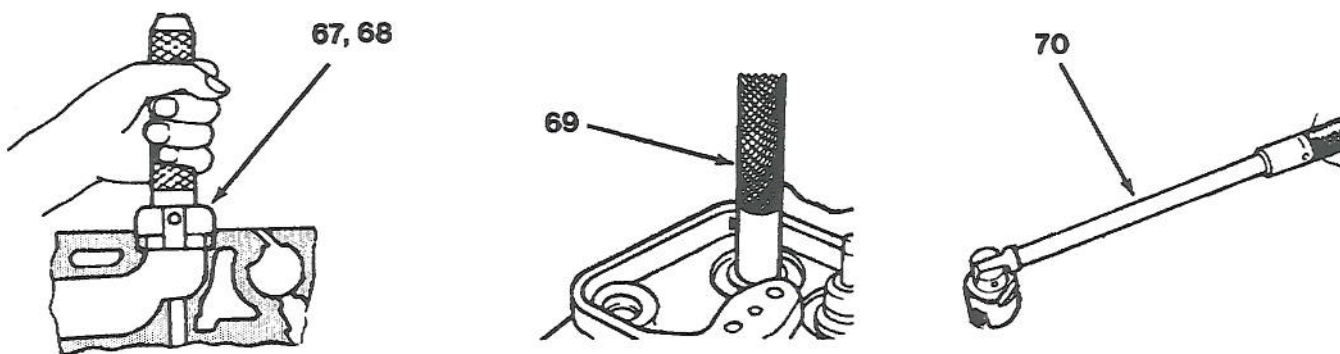


Figure 2-1. Special Tools (Sheet 7 of 7)

Chapter 3

PREPARATION FOR USE

3-1 GENERAL.

The purpose of this chapter is to provide the information required to prepare a vehicle for use or to determine that the vehicle is in satisfactory condition for operation.

3-2 PRELIMINARY INSPECTION.

When a new or reconditioned vehicle is first received by the using organization, it is necessary to determine that the vehicle is in satisfactory condition and will operate properly when first placed into service. The following procedures should be observed prior to placing a vehicle in service for the first time.

3-2.1 Visual Inspection. Visually inspect the vehicle upon receipt for obvious damage, such as broken, cracked, dented or missing parts. Carefully check pin-tle hooks in particular for secure mounting and proper operation.

3-2.2 Item Check. Check the following items for proper quantity:

- (1) Check engine coolant level with engine at normal operating temperature, as follows:



Remove the radiator cap only for testing or when filling the system after service. Removing the cap unnecessarily can cause loss of coolant and allow air to enter the system, which may cause damage by corrosion.

- (a) Check that engine coolant level is between the FULL and ADD marks on the coolant recovery bottle.
- (b) Add coolant to recovery bottle only if coolant level is below ADD mark.
- (e) If ambient temperature is below 32°F, also check level of antifreeze protection by testing coolant with a hydrometer.
- (2) Check fuel level.
- (3) Check engine oil level.
- (4) Check the automatic transmission fluid, as follows:

NOTE

Transmission fluid should be checked while transmission is at normal operating temperature. This occurs after the equivalent of at least 15 miles of highway driving. At normal operating temperature, the gauge end of the dipstick will be too hot to hold comfortably.

- (a) Bring transmission fluid up to normal operating temperature.
- (b) Place vehicle on level surface.
- (c) Run engine at idle speed.
- (d) Apply parking brake.
- (e) Move gearshift lever through all positions, leaving it in NEUTRAL.
- (f) Remove dipstick, located in fill tube at right rear of engine near dash panel, and wipe clean.
- (g) Insert dipstick until cap seats.
- (h) Remove dipstick and note reading. Fluid level should be between ADD and FILL marks.



Do not overfill. Overfilling can cause foaming which can lead to overheating, fluid oxidation or varnish formation. These conditions can cause interference with normal valve, clutch and servo operation. Foaming can also cause fluid to escape from the transmission vent where it may be mistaken for a leak.

- (i) If fluid level is at or below ADD mark, add sufficient fluid to raise level to ADD mark.
- (5) Check brake master cylinder as follows:
 - (a) Clean tops of covers and surrounding area.
 - (b) Remove covers.
 - (c) Fluid should be 1/4 inch below rim of each cell.
 - (d) If low, add brake fluid as required and install cover.
- (6) Check battery electrolyte level and add water as follows:

WARNING

Battery fluid contains sulphuric acid. When servicing batteries, wear eye protection (face shield), acid resistant rubber apron and gloves. Keep flames/sparks away from the vent and filler cap openings.

CAUTION

Do not spill battery acid on the vehicle's painted surfaces. If acid contacts any painted surface, flush immediately with water.

- (a) Lift battery cell caps and check each filler well. Fluid level should be above battery plates to the bottom of the filler well ring.
- (b) Add distilled water or drinking water free of high mineral content, if required.
- (c) Check battery charge using hydrometer.
- (7) Drain the water separator.
- (8) Drain the air reservoir.
- (9) Check drive belt tension. Check belts that drive the fan, air pump, alternator and power steering pump. Use tension gauge to check belt tension, as described in paragraph 5-5.1.10.
- (10) Check tire pressure, as described in paragraph 4-4.15.
- (11) Check windshield washer fluid level.
- (12) Check power steering pump fluid level. Fluid level may be checked with fluid hot or cold.

If below FULL HOT or FULL COLD marking on dipstick attached to reservoir cap, add fluid.

3-3 SWITCHES, GAGES AND LIGHTS.

Check switches, gauges and lights for proper operation, as follows:

- (1) Start engine and check temperature gauges, oil pressure gauge, air pressure gauge, ammeter and fuel level gauge.
- (2) Turn on all light switches and check for proper operation of lights, exterior and interior.
- (3) Check operation of horn by depressing center button in steering wheel.

3-4 OPERATIONAL CHECK.

Refer to Operation and Operator Maintenance Instructions Manual, and check operation of engine, transmission and brakes. Check that the parking brake will prevent truck motion with transmission in gear and engine at full stall speed.

3-5 LUBRICATION.

Check service records for indication of last periodic maintenance performed. Refer to Chapter 4 for proper vehicle lubrication and lubricant specifications.

Chapter 4

IN-USE INSPECTION, MAINTENANCE AND LUBRICATION

4-1 INTRODUCTION.

This chapter provides instructions for troubleshooting, inspection, engine tune-up and maintenance, adjustment, and lubrication. All servicing and maintenance must be performed at specified intervals to ensure optimum vehicle performance and minimum downtime.

4-2 MALFUNCTION ANALYSIS AND REMEDIAL ACTION.

Table 4-1 is divided into three parts titled Trouble, Probable Cause and Remedial Action. An electrical schematic is also provided to assist personnel in diagnosing and correcting malfunctions that may occur during normal operation. Refer to this table and schematic for information regarding the probable causes and remedial action required for the service troubles listed. When repair or replacement procedures for a component cannot be found here, refer to Chapter 5 and check the component's overhaul procedure.

4-3 SCHEDULED INSPECTION.

Table 4-2 provides a specific list of areas requiring inspection along with the interval at which each inspection is to be performed. Table 4-2 provides specific inspection instructions and identifies all points to be checked. Inspection intervals are based on normal operating conditions. Adjust intervals accordingly for extremes of temperature or other adverse operating conditions.

4-4 PERIODIC MAINTENANCE AND ADJUSTMENTS.

This section provides instructions for performing normal maintenance procedures and all necessary component adjustments. Refer to Chapter 5 for overhaul procedures.

Table 4-1. Troubleshooting

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Engine		
Engine will not crank.	<ol style="list-style-type: none"> 1. Batteries discharged. 2. Starter switch inoperative. 3. Starter inoperative. 4. Starter drive locked. 5. Engine seized. 	<ol style="list-style-type: none"> 1. Charge battery. 2. Replace defective component. 3. Replace starter. 4. Loosen starter bolts and free pinion. Replace starter drive if pinion cannot be freed. 5. Replace engine.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Engine-Continued		
Engine cranks, but will not start.	<ol style="list-style-type: none"> 1. Improper starting procedure. 2. No fuel in tank. 3. Injection pump timing off. 4. Valve timing off. 5. Air in fuel system. 6. Broken fuel line. 7. Defective fuel pump. 	<ol style="list-style-type: none"> 1. See Operator's Manual. 2. Fill fuel tank. 3. Adjust injection pump timing. 4. Check condition of timing chain and sprockets and position of timing marks. Repair or replace chain and sprockets and realign timing marks. 5. Run air out or bleed fuel lines. 6. Check for leakage. Replace damaged line. 7. Repair or replace fuel pump.
Engine hard to start.	<ol style="list-style-type: none"> 1. Loose or corroded, shorted battery connections. 2. Rundown battery. 3. Low ambient temperature. 4. Loose or corroded starter wiring connections. 5. Starter dragging (excessive amperage draw). 6. Faulty starter switch. 7. Faulty starter solenoid switch. 8. Faulty starter motor. 	<ol style="list-style-type: none"> 1. Clean terminals. Tighten or replace cables. 2. Recharge battery. 3. Perform cold climate starting procedures. 4. Tighten loose wiring. Replace corroded wiring. 5. Repair or replace starter. 6. Replace starter switch. 7. Replace solenoid switch. 8. Repair or replace starter motor.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Engine-Continued		
Engine hard to start-cont.	9. Faulty glow plugs. 10. Lack of fuel. 11. Damaged or incorrectly installed fuel line. 12. Air in fuel system. 13. Faulty feed pump. 14. Clogged fuel filter. 15. Faulty nozzle. 16. Incorrect injection timing. 17. Faulty injection pump. 18. Damaged ring gear. 19. High engine oil viscosity. 20. Incorrect valve clearance. 21. Incorrect valve timing. 22. Inadequate compression pressure. 23. Clogged air filter.	9. Replace glow plugs. 10. Add fuel. 11. Repair or replace fuel line. 12. Run out or bleed fuel lines. 13. Repair or replace feed pump. 14. Replace fuel filter. 15. Replace nozzle. 16. Adjust injection timing. 17. Repair or replace injection pump. 18. Replace ring gear. 19. Change oil (use lower weight oil). 20. Adjust valve clearance. 21. Adjust valve timing. 22. Defective piston rings, pistons, valves and head gaskets. Replace or repair. 23. Change air filter.
Engine starts, but fails to keep running.	Engine idle speed set too low.	Speed up engine idle to specifications.
Irregular engine operation.	1. No fuel or insufficient fuel. 2. Dirty fuel filter. 3. Governor instability. 4. Moisture in fuel due to condensation. 5. Fuel leakage from injection pipe. 6. Uneven fuel injection.	1. Fill fuel tank. 2. Replace fuel filter. 3. Repair or replace governor. 4. Check water/fuel separator for saturation. Empty and clean separator. 5. Repair or replace injection pipe. 6. Adjust nozzle.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Engine-Continued		
Irregular engine operation-cont.	7. Uneven injection pressure of nozzle.	7. Adjust nozzle.
	8. Improper fuel spray from nozzle.	8. Adjust nozzle.
	9. Improper adjustment of idle spring.	9. Adjust idle spring.
	10. Improper adjustment of damper spring.	10. Adjust damper spring.
	11. Malfunction of delivery valve.	11. Repair or replace delivery valve.
	12. Air in fuel system.	12. Bleed fuel system.
	13. Dirty air cleaner.	13. Replace air filter.
	14. Improper seating of valve seat.	14. Reseat valve seat.
	15. Improper valve clearance.	15. Adjust valve clearance.
	16. Incorrect valve timing.	16. Adjust valve timing.
	17. Uneven compression pressure.	17. Defective piston rings, pistons, valves and head gaskets. Replace or repair.
	18. Inadequate engine temperature.	18. Check cooling system. Repair as necessary.
	19. Improper idle adjustment.	19. Adjust idle.
	20. Incorrect adjustment of link or rod.	20. Adjust link or rod.
	21. Improper mounting of engine.	21. Adjust engine mounting.
	22. Excessive exhaust back pressure.	22. Free obstructions in exhaust system or replace parts as necessary.
Engine lacks power.	1. Incorrect fuel.	1. Drain fuel tank and add correct fuel.
	2. Improper adjustment of injection quantity.	2. Adjust injection quantity.
	3. Incorrect governor adjustment.	3. Adjust governor.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Engine-Continued		
Engine lacks power-cont.	4. Clogged fuel filter.	4. Replace fuel filter.
	5. Water or air in fuel.	5. Drain fuel. Check for water/fuel separator saturation. Empty and drain separator. Check for leaks in fuel tank or lines. Replace leaking lines.
	6. Malfunction of overflow valve.	6. Repair or replace overflow valve.
	7. Improper feed spray from nozzle.	7. Adjust nozzle.
	8. Improper injection timing.	8. Adjust injection timing.
	9. Malfunction of delivery valve.	9. Repair or replace delivery valve.
	10. Malfunction of feed pump.	10. Repair or replace feed pump.
	11. Malfunction of injection pump.	11. Repair or replace injection pump.
	12. Clogged air filter.	12. Replace air filter.
	13. Excessive intake air temperature.	13. Determine cause of overheating and correct.
	14. Clogged or crushed exhaust pipe or muffler.	14. Remove and unclog clogged exhaust pipe or muffler. Replace damaged pipe or muffler.
	15. Piston and cylinder liner wear.	15. Replace piston and cylinder liner.
	16. Worn, stuck or broken piston rings.	16. Replace piston rings.
	17. Worn or stuck valve guide.	17. Replace valve guide.
	18. Improper seating of valve seat.	18. Reseat valve seat.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Engine-Continued		
Engine overheating.	1. Scale or deposits in cooling system.	1. Drain and flush radiator.
	2. Radiator clogged.	2. Drain and flush radiator.
	3. Loose fan belt.	3. Adjust fan belt tension. Replace belt if worn.
	4. Lower coolant level.	4. Fill cooling system.
	5. Damaged coolant hose.	5. Replace coolant hose.
	6. Damaged or inoperative thermostat.	6. Replace thermostat.
	7. Water pump failure.	7. Repair or replace water pump.
	8. Water leak from cooling waterline.	8. Replace leaking waterline.
	9. Water leak due to faulty seal or packing.	9. Replace faulty seal or packing.
	10. Malfunction of radiator cap.	10. Replace radiator cap.
	11. Clogged or crushed core fin.	11. Clean radiator. Repair or replace radiator as necessary.
	12. Damaged bearing.	12. Replace bearing.
	13. Damaged impeller.	13. Replace impeller.
	14. Improper fuel spray from nozzle.	14. Adjust nozzle.
	15. Improper injection timing.	15. Adjust injection timing.
	16. Fuel leaking from cylinder head gasket.	16. Repair or replace cylinder head.
	17. Clogged or crushed exhaust pipe or muffler.	17. Repair or replace exhaust pipe or muffler.
	18. Temperature gauge reading incorrect.	18. Replace temperature gauge.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Engine-Continued		
Engine coolant too cool.	<ol style="list-style-type: none"> 1. Thermostat stuck open, or incorrect heat range. 2. Temperature transmitting unit defective (causing gauge to indicate low engine temperature). 3. Temperature gauge unit defective (not indicating true engine temperature). 	<ol style="list-style-type: none"> 1. Replace thermostat. 2. Check coolant temperature with thermometer. Replace transmitting unit if necessary. 3. Check coolant temperature with thermometer. Replace gauge unit if necessary.
Loss of coolant.	<ol style="list-style-type: none"> 1. Leaking radiator. 2. Loose or damaged hose connections. 3. Water pump leaking. 4. Cylinder head gasket defective. 5. Cylinder block core plugs leaking. 6. Cracked cylinder head. 	<ol style="list-style-type: none"> 1. Repair or replace. 2. Tighten or replace hoses. 3. Repair or replace. 4. Replace gasket. 5. Replace plugs. 6. Replace cylinder head.
Excessive oil consumption.	<ol style="list-style-type: none"> 1. Worn piston rings and cylinder liners. 2. Insufficient piston ring tension. 3. Piston ring installed upside down. 4. Broken piston rings. 5. Scuffing on piston rings and cylinder liner. 6. Worn valve stem guide. 7. Worn valve stem seal. 8. Clogged air filter. 	<ol style="list-style-type: none"> 1. Replace piston rings and cylinder 2. Replace piston rings. 3. Replace piston rings. 4. Replace piston rings. 5. Replace piston rings and cylinder liner. 6. Replace valve stem guide. 7. Replace valve stem seal. 8. Replace air filter.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Engine-Continued		
Excessive oil consumption-cont.	9. Leakage of engine oil.	9. Perform visual inspection of oil lines, gaskets, seals and engine block. Repair as necessary.
	10. Leakage of fuel.	10. Perform visual inspection of fuel lines, injection pump, fuel pump and fuel tank.
	11. Excess of engine oil.	11. Drain oil to proper level.
	12. Improper quality of engine oil.	12. Drain oil and add correct grade of oil.
Low lubricating oil pressure (engine at operating temperature).	1. Low oil level.	1. Refill.
	2. Oil by-passing oil cooler.	2. Clean oil lines and cooler.
	3. Faulty pressure gauge.	3. Replace pressure gauge.
	4. Faulty pressure sender.	4. Replace pressure sender.
	5. Oil filter clogged.	5. Replace oil filter element; clean filter.
Excessive fuel consumption.	1. Worn piston rings and cylinder liners.	1. Replace piston rings and cylinder
	2. Broken piston rings.	2. Replace piston rings.
	3. Worn valve stem guide.	3. Replace valve stem guide.
	4. Improper seating of valve seat.	4. Reseat valve seat.
	5. Incorrect valve clearance.	5. Adjust valve clearance.
	6. Improper fuel spray from nozzle.	6. Adjust nozzle.
	7. Incorrect injection quantity.	7. Adjust injection pump.
	8. Malfunction of delivery valve.	8. Repair or replace delivery valve.
	9. Improper injection timing.	9. Adjust injection timing.
	10. Clogged air filter.	10. Replace air filter.
	11. Leakage of fuel.	11. Perform visual inspection of fuel lines, injection pump, fuel pump and fuel tank. Repair as necessary.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Engine-Continued		
Black exhaust smoke.	<ol style="list-style-type: none"> 1. Clogged air filter. 2. Excessive air intake temperature. 3. Excessive fuel injection 4. Uneven wear on plunger. 5. Delivery valve malfunction. 6. Faulty nozzle. 7. Poor fuel quality. 8. Excessive advanced injection timing. 9. Wear on piston rings and cylinder liner. 10. Excessive oil in oil pan. 	<ol style="list-style-type: none"> 1. Change air filter. 2. Determine cause of overheating and correct. 3. Adjust injection pump. 4. Replace plunger and adjust position. 5. Repair or replace delivery valve. 6. Repair or replace nozzle. 7. Use better grade fuel. 8. Adjust injection pump timing. 9. Replace piston rings and cylinder liner. 10. Drain excess oil.
White exhaust smoke.	<ol style="list-style-type: none"> 1. Excessive delayed injection timing. 2. Excessive oil in oil pan. 3. Incorrect valve clearance. 4. Engine oil leaking down through valve stem. 5. Low engine temperature. 6. Wear on piston rings and cylinder liners. 	<ol style="list-style-type: none"> 1. Adjust injection pump timing. 2. Drain excess oil. 3. Adjust valve clearance. 4. Repair or replace valve stem. 5. Determine cause of low temperature and correct. 6. Replace piston rings and cylinder liners.
Transmission		
Slips in forward gears only.	<ol style="list-style-type: none"> 1. Low transmission fluid level. 2. Hydraulic control pressures out of adjustment. 3. Control valves sticking in body. 	<ol style="list-style-type: none"> 1. Add fluid to bring level to full mark on dip-stick. 2. Check and adjust. 3. Disassemble and repair control valve assembly.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Transmission-Continued		
Slips in forward gears only -cont.	<ol style="list-style-type: none"> Kickdown servo failure. Accumulator failure. Oil pump failure. Clutch failure. 	<ol style="list-style-type: none"> Disassemble, clean and repair. Disassemble, clean and repair. Disassemble and repair pump. Disassemble, clean and repair.
Slips in reverse only.	<ol style="list-style-type: none"> Low transmission fluid level. Hydraulic control pressures out of adjustment. Low and reverse band out of adjustment. Control valves sticking in body. Low and reverse servo failure. Oil pump or clutch failure. 	<ol style="list-style-type: none"> Add fluid to bring level to full mark on dip-stick. Check and adjust. Adjust low and reverse band. Disassemble and repair control valve assembly. Disassemble, clean and repair. Disassemble, clean and repair.
Slips in all gears.	<ol style="list-style-type: none"> Oil pump or seal ring failure. Low transmission fluid. Load too heavy. Overheating. Hydraulic control pressures out of adjustment. Control valves sticking in body. 	<ol style="list-style-type: none"> Disassemble and repair or replace defective parts. Add fluid to bring level to full mark on dip-stick. Reduce load. Check oil cooler for blockage. Clean if blocked. Check oil hoses for leaks. Replace leaking hoses. Check and adjust. Disassemble and repair control valve assembly.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Transmission-Continued		
No drive in any position.	<ol style="list-style-type: none"> 1. Low transmission fluid. 2. Hydraulic control pressures out of adjustment. 3. Oil strainer clogged. 4. Control valves sticking in body. 5. Torque converter drive plate or oil pump failure. 	<ol style="list-style-type: none"> 1. Add fluid to bring level to full mark on dip-stick. 2. Check and adjust. 3. Clean oil strainer; refill with clean fluid. 4. Disassemble and repair control valve assembly. 5. Disassemble and repair or replace defective parts.
No drive in forward gears only.	<ol style="list-style-type: none"> 1. Hydraulic control pressures out of adjustment. 2. Kickdown band out of adjustment or broken. 3. Control valves sticking in body. 4. Kickdown servo failure. 5. Accumulator failure. 6. Clutch failure. 	<ol style="list-style-type: none"> 1. Check and adjust. 2. Adjust or replace kickdown band. 3. Disassemble and repair control valve assembly. 4. Disassemble, clean and repair. 5. Disassemble, clean and repair. 6. Disassemble, clean and repair.
No drive in reverse gear only.	<ol style="list-style-type: none"> 1. Hydraulic control pressures out of adjustment. 2. Low and reverse band out of adjustment. 3. Control valves sticking in body. 	<ol style="list-style-type: none"> 1. Check and adjust. 2. Adjust low and reverse band. 3. Disassemble and repair control valve assembly.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Transmission-Continued		
No drive in reverse gear only-cont.	4. Low and reverse servo failure. 5. Clutch failure.	4. Disassemble, clean and repair. 5. Disassemble, clean and repair.
Erratic shifting.	1. Low transmission fluid. 2. Engine idle speed too high. 3. Hydraulic control pressures out of adjustment. 4. Kickdown band out of adjustment. 5. Governor stuck or malfunctioning. 6. Oil strainer clogged. 7. Control valves sticking in body. 8. Oil pump malfunction.	1. Add fluid to bring level to full mark on dip-stick. 2. Adjust engine idle speed. 3. Check and adjust. 4. Adjust kickdown band. 5. Disassemble and repair governor. 6. Clean oil strainer; refill with clean fluid. 7. Disassemble and repair control valve assembly. 8. Disassemble and repair, or replace oil pump.
Hard to fill, oil blows out filler tube during operation.	1. Transmission overfilled. 2. Oil strainer clogged. 3. Control valves sticking in body. 4. Transmission vent clogged. 5. Oil pump failure.	1. Drain excess oil. 2. Clean oil strainer; refill with clean fluid. 3. Disassemble and repair control valve assembly. 4. Clean vent to remove obstruction. 5. Disassemble and repair oil pump.
Transmission overheats.	1. Low transmission fluid level. 2. Kickdown band out of adjustment. 3. Low and reverse band out of adjustment. 4. Oil cooler clogged.	1. Add fluid to bring level to full mark on dip-stick. 2. Adjust kickdown band. 3. Adjust low and reverse band. 4. Clean radiator and oil cooler.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Transmission-Continued		
Transmission overheats-cont.	5. Control valves sticking in valve body.	5. Disassemble and repair valve body.
	6. Oil pump failure.	6. Disassemble and repair oil pump.
	7. Clutch failure.	7. Disassemble, clean and repair.
Steering System		
Hard steering.	1. Incorrect tire pressure.	1. Check tire pressure.
	2. Lack of lubrication.	2. Lubricate
	3. Incorrect front wheel alignment.	3. Align
	4. Steering gear sluggish.	4. Overhaul steering gear. Check for wear or damage.
	5. Belt out of adjustment.	5. Tighten belt.
Erratic steering.	1. Defective power steering gear.	1. Repair or replace steering gear.
	2. Defective pump assembly.	2. Repair or replace pump assembly.
	3. Loose, worn or damaged steering linkage or connections.	3. Tighten or replace as necessary.
	4. Dirt in steering hydraulic system.	4. Disassemble and clean or replace parts as required.
	5. Incorrect front wheel bearing adjustment.	5. Adjust.
Loose steering.	1. Loose, worn or damaged steering linkage or connections.	1. Tighten or replace as necessary.
	2. Excessive wear in valve or cylinder.	2. Disassemble and repair.
	3. Incorrect front wheel bearing adjustment.	3. Adjust.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Steering-Continued		
Vehicle pulls to one side.	<ol style="list-style-type: none"> 1. Incorrect tire pressure. 2. Rear spring tie bolt off center. 3. Bent spindle or spindle arm. 4. Incorrect front wheel bearing adjustment. 5. Incorrect front wheel alignment. 6. Power steering spool misaligned or stuck. 	<ol style="list-style-type: none"> 1. Check and correct tire pressure. 2. Position correctly. 3. Replace. 4. Adjust. 5. Align. 6. Clean or replace power steering spool.
Brakes		
Spongy brake pedal action.	<ol style="list-style-type: none"> 1. Air in hydraulic lines. 2. Fluid level in master cylinder reservoir low. 3. Incorrect brake adjustment. 4. Master cylinder piston cup leaking. 5. Wheel cylinder or cylinders leaking. 	<ol style="list-style-type: none"> 1. Repair system to prevent air entering lines. Bleed brake system. 2. Refill master cylinder reservoir and check entire brake system for fluid leaks. Repair if necessary. Bleed brakes. 3. Adjust or reline. 4. Repair or replace master cylinder. Bleed brake system. 5. Repair or replace defective wheel cylinders. Bleed brake system.
Excessive pedal travel.	<ol style="list-style-type: none"> 1. Low hydraulic pressure. 2. Normal brake wear. 	<ol style="list-style-type: none"> 1. Check brake fluid level. Add fluid. Check brake lines and connections for leaks. Replace leaking lines. 2. Adjust or reline brakes as necessary.
Uneven, noisy, grabbing or hard brakes.	<ol style="list-style-type: none"> 1. Excessive dust or dirt in brake lining rivet holes or in brake drum. 2. Drums out of round. 3. Frozen master cylinder or wheel cylinder pistons. 	<ol style="list-style-type: none"> 1. Clean dirt with scraper or air hose. 2. Turn drums to restore roundness or replace drums. 3. Replace defective cylinder.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Brakes-Continued		
Uneven, noisy, grabbing or hard brakes -cont.	<ol style="list-style-type: none"> 4. Improper brake shoe adjustment. 5. Warped or misaligned shoes. 6. Glazed linings. 7. Greasy linings. 	<ol style="list-style-type: none"> 4. Adjust shoes correctly. 5. Replace shoes. 6. Remove glaze with medium grade sandpaper. 7. Replace linings and check for source of grease.
Brakes do not release.	<ol style="list-style-type: none"> 1. Improperly adjusted brake pedal. 2. Restricted bypass port in master cylinder. 3. Swollen master cylinder piston cups. 4. Wheel cylinders sticking due to dirty or contaminated brake fluid. 	<ol style="list-style-type: none"> 1. Adjust pedal free-travel to 3/16 to 3/8 inch. 2. Replace master cylinder. 3. Rebuild master cylinder. 4. Clean the entire hydraulic system with denatured alcohol, Specification MIL-A-6091, and refill system with new brake fluid. Bleed brake system.
Brake pedal travels to floorboard without noticeable brake action.	Fluid level low in master cylinder reservoir.	Refill master cylinder reservoir and check entire brake system for fluid leaks. Repair if necessary. Bleed brakes.
Brakes drag.	<ol style="list-style-type: none"> 1. Defective brake shoe return spring. 2. Loose or damaged wheel bearing. 3. Linings improperly adjusted. 	<ol style="list-style-type: none"> 1. Replace return spring. 2. Replace wheel bearing. 3. Adjust linings.
Brakes "grab"; vehicle pulls to one side on brake application.	<ol style="list-style-type: none"> 1. Improperly inflated tires. 2. Linings grease soaked. 3. Linings improperly adjusted. 	<ol style="list-style-type: none"> 1. Inflate to correct pressure. 2. Clean linings. 3. Adjust linings.
Slow brake application.	<ol style="list-style-type: none"> 1. Low hydraulic pressure. 2. Brake improperly adjusted. 	<ol style="list-style-type: none"> 1. Check brake fluid level. Add fluid. Check brake lines and connections for leaks. Replace leaking lines. 2. Adjust brakes.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Brakes-Continued		
Brakes squeal on application.	<ol style="list-style-type: none"> 1. Glazed or dirty linings. 2. Lining worn to rivet heads. 	<ol style="list-style-type: none"> 1. Clean or replace linings. 2. Replace linings.
Electrical		
Batteries discharge rapidly.	<ol style="list-style-type: none"> 1. Alternator, regulator or wiring faulty. 2. Loose connectors or corroded battery terminals. 3. Voltage regulator not functioning properly. 4. Short circuit in the electrical system. 5. Defective cell in battery. 	<ol style="list-style-type: none"> 1. Repair or replace alternator or regulator. Replace faulty wiring. 2. Clean terminals and connectors. Tighten connectors. 3. Repair or replace voltage regulators. 4. Replace faulty section of wiring. 5. Replace battery.
No battery voltage.	<ol style="list-style-type: none"> 1. Battery discharged. 2. Circuit breaker open. 3. Disconnected battery cable. 4. Master relay defective. 	<ol style="list-style-type: none"> 1. Perform hydrometer test; charge battery. Perform heavy load tests. If battery is not defective, charge. 2. Reset circuit breaker. 3. Connect cable. 4. Repair or replace master relay.
Improper system voltage.	<ol style="list-style-type: none"> 1. Alternator belt slipping. 2. Defective voltage regulator. 3. Insufficient alternator output. 	<ol style="list-style-type: none"> 1. Tighten or replace belt as necessary. 2. Replace voltage regulator. 3. Repair or replace alternator.
Lights dim.	<ol style="list-style-type: none"> 1. Low battery voltage. 2. Poor electrical connections. 	<ol style="list-style-type: none"> 1. Check battery connections and wiring. Perform hydrometer and heavy load tests. If battery is defective, replace. 2. Check wiring. Reconnect any bad connections.
Lights inoperative.	<ol style="list-style-type: none"> 1. Defective bulb. 2. Faulty circuit breaker or fuse. 	<ol style="list-style-type: none"> 1. Replace bulb. 2. Replace circuit breaker or fuse.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Brakes-Continued		
Lights inoperative -cont.	3. Broken lead. 4. Defective switch.	3. Replace lead. 4. Replace switch.
Frequent lamp failures.	1. Improper electrical system voltage. 2. Poor battery connections.	1. Check for alternator belt slippage, defective voltage regulator and insufficient alternator output. Repair or replace components as necessary. 2. Clean battery terminals and connections. Tighten connector.

NOTE

Constant voltage regulator built into the fuel gauge.

Lights and fuses fail prematurely. Short battery life. Battery uses excessive amount of water. High charging rate.	Voltage limiter setting too high.	Replace fuel gauge.
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Fuel System

(See Engine section of this table for troubleshooting procedures for excess fuel consumption)

Fuel gauge readings are incorrect.	1. Poor electrical connections. 2. Fuel level transmitter defective. 3. Fuel gauge defective. 4. Voltage limiter defective.	1. Clean and tighten all connections. 2. Replace fuel level transmitter. 3. Replace fuel gauge. 4. Replace fuel gauge.
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Driveshaft

Noisy drive line.	1. Out of balance. 2. Badly worn parts.	1. Realign driveshaft. 2. Replace worn parts.
Drive line vibration.	1. Yokes out of line. 2. Shafts out of balance.	1. Realign yokes. 2. Balance shaft.

Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Axle		
Noise from drive axle.	<ol style="list-style-type: none"> 1. Lubricant not to specified level. 2. Incorrect lubricant. 3. Worn bearings. 	<ol style="list-style-type: none"> 1. Add lubricant to proper level. 2. Drain lubricant. Add correct lubricant. 3. Replace bearings.
Lubricant leaks through axle shafts.	<ol style="list-style-type: none"> 1. Incorrect kind and weight of lubricant. 2. Lubricant above specified level. 	<ol style="list-style-type: none"> 1. Drain lubricant. Add correct lubricant. 2. Drain excess lubricant.
Excessive tire wear.	<ol style="list-style-type: none"> 1. Improper tire inflation. 2. Incorrect toe-in. 	<ol style="list-style-type: none"> 1. Correct inflation. 2. Adjust toe-in.
Exhaust System		
Exhaust gas leakage.	<ol style="list-style-type: none"> 1. Loose pipe connections. 2. Deteriorated exhaust piping or muffler. 	<ol style="list-style-type: none"> 1. Tighten. 2. Replace parts as required.
Excessive noise.	<ol style="list-style-type: none"> 1. Deteriorated muffler and/or exhaust piping. 	<ol style="list-style-type: none"> 1. Replace parts as required.
Windshield Wipers		
Wipers do not move.	<ol style="list-style-type: none"> 1. No electrical connection. 2. Defective motor. 	<ol style="list-style-type: none"> 1. Connect connector. 2. Repair or replace motor.
Air System		

WARNING

Methyol alcohol is flammable. Ensure ignition is off and engine is cool before draining and/or adding alcohol to the alcohol injector. Severe burns can result if engine is hot or the engine is left running.

NOTE

Before attempting troubleshooting procedures, drain alcohol injector and refill with methyol alcohol.

System failure in cold weather.	<ol style="list-style-type: none"> 1. Ice in system. 	<ol style="list-style-type: none"> 1. Start and leave engine running. Set HEATER switch to ON position. Allow engine to run until cab in vehicle is warm. Turn ignition off and bleed off air in tanks. Remove drain plugs and drain all fluids. Thread and tighten drain plugs. Start engine and observe pressure gauge. If pressure gauge reads correctly, open all valves and ensure air flows through all gladhand couplings.
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Table 4-1. Troubleshooting-Continued

Trouble	Probable Cause	Checkout Procedure And Remedial Action
Air System-Continued		
System failure cold weather - cont.	2. Defective air governor.	2. Repair or replace air governor.
	3. Defective air compressor.	3. Repair or replace air compressor.
Outlet pressure low.	1. Ice in system.	1. Refer to system failure step 1 above.
	2. Air lines kinked, split, or obstructed.	2. Check; replace lines as necessary.
	3. Defective air governor.	3. Repair or replace air governor.
	4. Defective air compressor.	4. Repair or replace air governor.
Winterization System		
No power to system.	1. Facility power off.	1. Activate facility power.
	2. Loose plug connection.	2. Check; repair as necessary.
	3. Fuse on junction box assembly defective.	3. Replace fuse.
	4. No power after fuse replacement.	4. Check all wiring for continuity. If continuity checks out, ensure plug and receptacle are not corroded. Replace parts as necessary.
Engine hard to start and idles roughly until engine warms up.	1. Defective battery warmer.	1. Replace battery warmer.
	2. Defective oil thermostat or heater.	2. Replace thermostat or heater as necessary.
Air from heater very cold during engine start-up.	1. Defective coolant thermostat or heater.	1. Replace thermostat or heater as necessary.

Table 4-2. Scheduled Inspection Chart

	Inspection Interval	
	Scheduled	Safety
	3 months or 300 operating hours, whichever comes first	Annual, or 1200 operating hours, whichever comes first
AXLES		
Check and tighten wheel mounting nuts.	X	
Check security of axle mounting to frame.		X
Check differentials for oil leaks.	X	
Check differential and reduction gear case lubricant level.	X	
WHEELS AND TIRES		
Check tires for cuts or foreign objects.	X	
Check hub bolt nuts.	X	
Check bearings for looseness.		X
Check oil seals.	X	
Remove wheelbearings and check bearings and race for defects.		X
BRAKES-SERVICE		
Check master cylinder fluid level.	X	
Check brake lines for leaks.	X	
Inspect linings for wear.		X
Inspect pads for wear		X
BRAKES-PARKING		
Check linkage and cable for wear, and adjust.	X	
Check linings for wear.		X
COOLING SYSTEM		
Check antifreeze protection.	X	
Check coolant color and cleanliness.	X	
Check all hoses and connections for leaks.	X	
Check water pump inlet and outlet connection for leaks.	X	
Flush coolant system.		X
Check radiator for leaks and mounting for security.	X	
Check thermostat operation and housing for tightness.	X	

Table 4-2. Scheduled Inspection Chart-Continued

	Inspection Interval	
	Scheduled	Safety
	3 months or 300 operating hours, whichever comes first	Annual, or 1200 operating hours, whichever comes first
ENGINE		
Check cylinder head nuts.		X
Check manifold nuts and gasket.		X
Check tappet clearance and oil supply to valve springs and seats.		X
Check and adjust water pump and alternator belt tension.	X	
ENGINE FUEL SYSTEM		
Replace fuel filter.		X
Drain fuel tank to remove water and sediment.	X	
Check all fuel lines for leaks.		X
Check fuel supply gauge for accuracy.	X	
Check fuel pump gaskets for leaks.	X	
Visually check fuel tank for leaks.	X	
Check accelerator linkage clevis pins and cotter pins for wear or damage.	X	
Inspect air cleaner filter.	X	
ENGINE ALTERNATOR		
Check for worn brushes.		X
Check voltage regulator output.	X	
ELECTRICAL		
Check all connections.		X
Check for chafed or broken wires.		X
Check retaining clips and grommets.		X
BATTERY		
Check specific gravity.	X	
Check terminals and cables for corrosion and tightness.	X	
TRANSMISSION		
Check fluid level.	X	
Check for oil leaks.	X	
Drain and refill.		X

Table 4-2. Scheduled Inspection Chart-Continued

	Inspection Interval	
	Scheduled	Safety
	3 months or 300 operating hours, whichever comes first	Annual, or 1200 operating hours, whichever comes first
AIR SYSTEM		
Check drive belt tension.	X	
Check lines and fittings for leaks and/or looseness.	X	
Check air filter.	X	
WINTERIZATION SYSTEM		
Check all hoses and connections for leaks.	X	
Check oil pan heater for leaks.	X	
Check all electrical wiring and connections for corrosion and chafed or broken wires.		X

4-4.1 Fuel System Service. The following paragraphs contain procedures for checking and adjusting the fuel system components. All maintenance procedures must be performed at scheduled intervals.

- a. Replacing fuel filter element.
 - (1) Disconnect fuel lines and remove fuel filter from bracket.
 - (2) Remove filter element.
 - (3) Install new element on cover.
 - (4) Install fuel filter in bracket and connect fuel lines.
- b. Adjusting injection pump. Refer to paragraph 5-5.1.21 for injection pump adjustment procedures.
- c. Adjusting fuel injectors. Refer to paragraph 5-5.1.21 for fuel injector adjustment procedures.
- d. Draining fuel water separator. Drain water from fuel water separator at scheduled intervals.
- e. Checking fuel pump. Refer to paragraph 5-5.1.14 and check fuel pump at scheduled intervals.
- f. Cleaning gauge filter of fuel pump. Clean gauge filter at scheduled intervals.
- g. Checking fuel injection timing and pressure. Refer to paragraph 5-5.1.14 and check fuel injection timing and pressure.
- h. Adjusting governor. Refer to paragraph 5-5.1.20 and adjust governor.
- i. Checking and replacing air filter.
 - (1) Remove wing nut and packing from air cleaner and remove air cleaner cover.
 - (2) Separate element and packing rings.
 - (3) Check air filter element for excessive dirt. If dirty, replace regardless of scheduled interval.
 - (4) Install element and packing in air cleaner.
 - (5) Install cover using packing and wing nut.

4-4.2 Cooling System Service. The following paragraphs contain procedures for checking coolant level and adding coolant, as well as draining and refilling the coolant system and testing the thermostat. All maintenance procedures must be performed at scheduled intervals.

- a. Checking and adding coolant.

WARNING

Do not remove radiator cap if vehicle has been running for any period of time as serious burns to personnel may result.

CAUTION

Remove the radiator cap only for testing or when filling the system after service. Removing the cap unnecessarily can cause loss of coolant and allow air to enter the system, which may cause damage by corrosion.

- (1) Check that engine coolant level is between the FULL and ADD marks on the coolant recovery bottle.
- (2) Add coolant to recovery bottle only if coolant level is below ADD mark.
- (3) If ambient temperature is below 32°F, also check level of antifreeze protection by testing coolant with a hydrometer.

NOTE

In an emergency, water alone may be added. However, check the freeze protection as soon as possible, as the addition of water will dilute the antifreeze, reducing its efficiency.

- b. Draining and refilling coolant system.

WARNING

Do not remove radiator draincock or block drain plug when engine has been running for any length of time as burns to personnel may result.

- (1) Loosen draincock on bottom of radiator.
- (2) Remove drain plug from left-rear of cylinder block.
- (3) Tighten radiator draincock and replace block drain plug.

WARNING

Ethylene glycol is toxic to the eyes, skin and respiratory tract. Eye and skin protection is required. Ethylene glycol should only be used in a well-ventilated area.

- (4) Remove radiator cap and add 50/50 mixture of ethylene glycol antifreeze and water to radiator until level reaches to a level of 1-1/2 to 2 inches below filler cap (with vehicle not running).
- (5) Replace radiator cap.
- c. Thermostat testing. Refer to the cooling system paragraph of Chapter 5 of this manual for thermostat testing procedures.

4-4.3 Belt Service. This paragraph contains procedures for checking belts that drive the fan, alternator, air compressor, and power steering pump at scheduled intervals. Check for cracks, fraying, wear and general belt condition. Use tension gauge #J-23600 to check belt tension. Compare readings to chart below and adjust belt tension if necessary.

<i>Belt</i>	<i>Tension (lb-ft)</i>
Fan and Alternator	294-377 (400-512 Nm)
Power Steering	294-377 (400-512 Nm)
Air Compressor	294-377 (400-512 Nm)

If installing new belts, adjust to tension shown in chart above.

4-4.4 Engine Oil and Oil Filter Change. The following paragraphs contain procedures for checking oil level condition and for changing the oil and oil filter. All maintenance procedures must be performed at scheduled intervals.

a. Checking oil.

- (1) Remove dipstick and wipe clean.
- (2) Insert dipstick until cap seats.
- (3) Remove dipstick and note reading. Fluid level should be between ADD and FULL marks.
- (4) Note color and consistency of oil. If oil appears opaque or gummy, refer to the following oil change procedures.
- (5) If level is at or below ADD mark, add oil through filler port until dipstick reading is above ADD mark.
- (6) Refer to figure 4-5, for the correct oil.

b. Changing oil and oil filter.

- (1) Place a receptacle under oil pan and remove drain plug.
- (2) Allow oil pan to drain completely.
- (3) Replace oil pan drain plug. Tighten to torque specified in table 6-2.
- (4) Move receptacle under oil filter.
- (5) Drain filter by loosening center bolt and remove filter element, gasket, case, spring and other parts from body.
- (6) Replace the filter element with a new filter element.

- (7) Clean all parts except filter element with light oil.
- (8) Assemble oil filter, replacing gasket, and install on vehicle. Tighten to torque specified by table 6-2.
- (9) Refer to figure 4-5 to match correct oil types to climate.
- (10) Add 7.9 quarts of oil to engine through filler port.
- (11) Check oil level, using dipstick, and add oil if necessary.

4-4.5 Brake System Service. The following paragraphs contain procedures for inspecting, servicing

and adjusting brake equipment. All maintenance procedures must be performed at scheduled intervals.

a. Checking master cylinder and adding brake fluid.

- (1) Clean tops of master cylinder covers and surrounding area.
- (2) Remove cover and inspect brake fluid level in each cell. Fluid should reach to below rims of each cell in reservoirs.
- (3) If level is low, add fluid meeting SAE Standard J1703 until brake fluid reaches appropriate level.
- (4) Replace covers.

b. Rear drum brake adjustment. The rear drum brakes are the vehicle's only adjustable service brakes. If the rear brakes are disassembled for any reason, an initial adjustment must be performed before installing the drum.

- (1) To perform initial adjustment with drums removed, use brakeshoe-to-drum clearance gauge #J-21177-01 to preset brake lining adjustment. Drums should fit over brake lining with slight drag.

NOTE

Manual adjustment of the rear brakes, with the drums in place, may be accomplished beginning with step 2.

- (2) Remove access slot covers from brake support plates.

CAUTION

The automatic adjuster lever must be disengaged from the adjuster screw before the screw can be rotated or damage to brake components may occur. Use a thin blade screwdriver or section of 1/8 inch welding rod to unseat adjuster lever.

- (3) Rotate adjuster screw in clockwise direction, using brake adjusting tool, until brakes are locked.
 - (4) Rotate adjuster screw in counterclockwise direction until wheel rotates freely.
 - (5) Install access slot cover in brake support plane.
 - (6) Check brake operation before moving vehicle.
 - (7) Complete rear brake and pedal travel adjustment by driving vehicle in reverse and making 10 to 15 firm brake applications. Make one forward brake application between each reverse application to equalize adjustment.
- c. Bleeding brakes. It is necessary to bleed the brake hydraulic system whenever a line has been disconnected or air has entered the system.
- (1) Manual bleeding.
 - (a) Follow procedure given for master cylinder inspection in paragraph 4-4.5a.
 - (b) Loosen metering valve front mounting bolt and insert slotted end of tool #J-23709 under bolt.
 - (c) Push metering valve stem (using tool) to hold valve open and tighten mounting bolt to secure tool.

NOTE

Brake system should be bled in the following sequence:

1. Right rear wheel
 2. Left rear wheel
 3. Right front wheel
 4. Left front wheel
 5. Master cylinder brake line connections.
- (d) Place wrench on bleeder screw. Install rubber hose on screw with free end submerged in transparent container partially filled with clean brake fluid.

- (e) Open bleeder screw 3/4 turn.
- (f) Have other personnel depress brake pedal.
- (g) Close bleeder screw before pedal reaches end of travel.
- (h) Have helper pump up pedal each time bleeder screw is turned. This ensures a strong surge of fluid when screw is reopened.
- (i) Repeat bleeding process until fluid comes out in solid stream without air bubbles.

CAUTION

Do not allow supply of fluid in master cylinder to become exhausted. Check fluid level frequently while bleeding and refill as required. Do not bleed two wheels at a time, and do not bleed the system with the front calipers or rear drums not in place.

- (j) Refill master cylinder as required and install covers and retainer.
 - (k) Remove metering valve tool.
- (1) Test brake operation before moving vehicle.
 - (2) Pressure bleeding.
 - (a) Remove accumulated dirt from master cylinder and cover.
 - (b) Remove cover and rubber diaphragm seal and place cover on lint-free cloth or workbench.

CAUTION

Do not allow cover or diaphragm to contact dirt or foreign material.

- (c) Fill master cylinder if required.
- (d) Install brake bleeder adapter cover on master cylinder.
- (e) Connect hose from pressure bleeder to fitting on adapter and open pressure bleeder release valve.
- (f) Loosen metering valve front mounting bolt and insert end of tool #J-23709 under bolt.
- (g) Push metering valve stem inward (using tool) to hold valve open and tighten mounting bolt to secure tool.

NOTE

Bleed the brake system in the sequence given in manual bleeding procedure.

When using pressure equipment, the bleeding procedure is the same as the one outlined in the manual bleeding procedure, except that no other personnel are needed to depress brake pedal.

- (h) When system has been purged of all air, turn off pressure bleeder and close bleeder fluid release valve.
- (i) Disconnect pressure bleeder hose at adapter fitting and remove master cylinder cover adapter.
- (j) Refill master cylinder to within 1/4 inch of reservoir rims.
- (k) Install cover and rubber diaphragm seal. Make sure cover retainer is in place.
- (l) Loosen metering valve front mounting bolt, remove tool #J-23709 and retighten mounting bolt.
- (m) Test brake operation before moving vehicle.
- d. Front brake linings. Check brake lining thickness through caliper inspection port. See figure 4-1. A wear sensor is attached to the brakeshoes. When brake lining wears to the point at which replacement is necessary, a sensor contacts the disc, making screeching or scraping noise to warn driver that brakeshoes need replacement.
- e. Rear brake lining. Replace linings worn to within 1/32-inch of rivet head.
- f. Run self-adjusting mechanism. Operate adjuster lever and pivot. Check for ease of operation of adjuster screw assembly. Check condition of adjuster components for bending, loose or overheated springs or binding.
- g. Disc brake calipers. Check duct boot for correct installation, tears or signs of leakage, or kinked lines or loose fitting.
- h. Rear wheel cylinders. Pull duct boot back and inspect for leaks. Check condition of pistons and cylinder bores.
- i. Differential warning valve. Check valve and housing for signs of leaks, kinked lines or loose fitting.
- j. Brakelines, fitting and hoses. Check for cracks, swelling, kinks, distortion or leaks. Also, in-

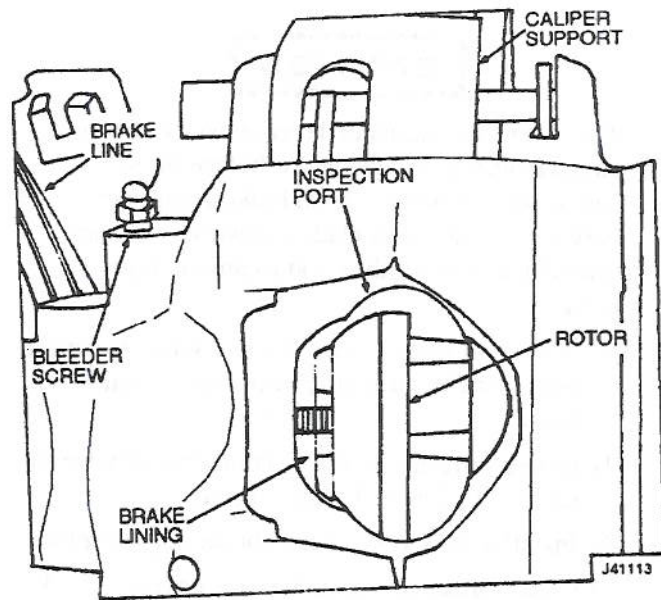


Figure 4-1. Caliper Inspection Port

spect position to be sure no lines are rubbing against exhaust system parts or other components.

- k. Parking brake. Operate parking brake; release and check for smooth operation and brake holding ability. Inspect cables for binds, kinks or frays. With brake released, the rear wheels should turn freely. Adjust parking brake as follows:

NOTE

The service brakes must be adjusted before adjusting the parking brakes.

- (1) Release parking brakes.
- (2) Loosen equalizer locknuts to release tension on cables.
- (3) Inspect all cables for binds, kinks or frayed condition. Replace damaged cables.
- (4) Tighten equalizer locknut until slight drag is produced at wheels.
- (5) Loosen equalizer locknut until wheels rotate freely and brake drag is eliminated.
- (6) Tighten equalizer locknuts securely.
- (7) Check parking brake operation.
- l. Overall brake condition and action. Check for improper brake action, performance complaints or signs of overheating, dragging or pulling. Correct as required.

4-4.6 Battery and Cable Service. The following paragraphs contain procedures for inspection and servicing of the battery and battery cables. All maintenance procedures must be performed at scheduled intervals.

WARNING

Battery fluid contains sulphuric acid. When servicing batteries always wear eye protection (face shield), acid resistant rubber apron and gloves. Keep flame/sparks away from the vent and filler cap openings.

a. Checking and adding electrolyte.

- (1) Lift battery cell caps and inspect fluid level in each cell. Electrolyte should reach bottom of each filler well ring.
- (2) If electrolyte level is low, add distilled or low mineral water to cells until electrolyte reaches appropriate levels.

NOTE

In freezing weather, add water before driving to assure its mixing with acid and to prevent freezing.

b. General winter battery inspection.

WARNING

Whenever disconnecting battery terminals, always disconnect GROUND (negative) terminal first to avoid sparking and danger of explosion.

CAUTION

Handle the battery carefully when removing or replacing it, and avoid tipping it as battery acid is corrosive to painted surfaces.

- (1) Disconnect battery negative cable, then remove positive cable.
- (2) Clean cables and terminal posts with a wire brush terminal cleaner.
- (3) Check battery fluid level and add water, if necessary.
- (4) Remove battery holddown and clean battery case and battery tray, if necessary, with a solution of baking soda and water; then rinse thoroughly.
- (5) Position battery in tray and fasten holddown. Do not overtighten.

WARNING

When connecting battery terminals, always connect POSITIVE terminal first to avoid sparking and danger of explosion.

- (6) Attach positive battery cable, then attach negative cable.
 - (7) Apply a small amount of grease or protective coating to cable ends to minimize corrosion.
- c. Cable inspection and replacement.
- (1) Check battery cables thoroughly for damage, fraying or excessive wear.
 - (2) Replace any worn or damaged cables.

4-4.7 Engine Performance Check. Table 4-3 contains performance specifications for engine components. Refer to paragraph 4-4.8 for tune-up procedures for any components not operating to the specifications.

4-4.8 Engine Tune-Up. Engine tune-up consists of adjusting the governor, valve clearance, injection pump timing and injector nozzles. Refer to this paragraph and paragraph 4-2 for procedures for adjusting and servicing components affecting engine performance.

- a. Adjusting valve clearance. Refer to paragraph 5-5.1.23 and adjust valve clearance.
- b. Adjusting governor. Refer to paragraph 5-5.1.20 and adjust governor.
- c. Adjusting injection pump timing. Refer to paragraph 5-5.1.21 and adjust injection pump timing.
- d. Adjusting injector nozzles. Refer to paragraph 5-5.1.16 and adjust injector nozzles.

4-4.9 Exhaust System Service. Inspect the exhaust system at scheduled intervals for leaks, damage and misalignment. In addition, check exhaust system for grounding against body sheet metal or frame.

4-4.10 Transmission Service. The following paragraphs contain procedures for checking fluid level and condition. Inspections must be made at scheduled intervals while the transmission is at normal operating temperature. Change transmission fluid at scheduled intervals or when fluid condition requires it.

- a. Checking and adding transmission fluid.

Table 4-3. Engine Component Performance Specifications

Item			Nominal Dimension	Maintenance Standard	Repair Limit	Remarks
Idling	rpm	-	-	600	-	Engine as single unit. Idling speed should be stabilized.
Engine Oil Pressure	at 1500 rpm	-	-	44.1-45.5 psi	28.4 psi	Oil temperature: 158-176°F
	at Idling	-	-	14.223 psi	7.1 psi	
Compression Pressure	Pressure	-	-	426.7 psi	270.2 psi	Engine rpm: 200 ± 20 rpm (warm engine)
	Difference between Cylinders	-	-	56.9 psi	-	
Engine Oil Consumption	h/L	-	-	-	Less than 40% of initial value when operated under the same condition	Observe the color of exhaust fumes.
Fuel Consumption	h/L	-	-	-	Less than 60% of initial value when operated under the same condition.	Observe the color of exhaust fumes.
Valve Timing	Inlet Valve	Open 28° B.T.D.C.	-	-	-	When valve clearance is adjusted to greater than 0.012 inch and less than 0.016 inch.
		Close 67° A.B.D.C.	-	-	-	
	Exhaust Valve	Open 67° B.B.D.C.	-	-	-	
		Close 28° A.T.D.C.	-	-	-	
Fuel Injection Timing	B.T.D.C.	20°	-	-	-	Measured by crank angle.

WARNING

At normal operating temperature, the gauge end of the dipstick will be too hot to hold comfortably. Injury to personnel may result.

- (1) Place vehicle on level surface.
- (2) Have engine running at idle speed.
- (3) Apply parking brake.
- (4) Move gearshift lever through all positions. Then move it to NEUTRAL.

WARNING

Stay clear of fan and drive belts when engine is running or injury may result.

- (5) Remove dipstick, located in fill tube at right rear of engine near dash panel, and wipe clean.
- (6) Insert dipstick until cap seats.
- (7) Remove dipstick and check fluid level reading. Level should be between ADD and FULL marks.

CAUTION

Do not overfill. This can lead to foaming which can lead to overheating, fluid oxidation or varnish formation, all of which can interfere with transmission operation.

To check fluid condition note whether fluid smells burned or is full of metal or friction material particles. If so, a complete transmission overhaul may be needed.

- (8) If level is at or below the ADD mark, add sufficient fluid to raise level to FULL mark.
- b. Changing transmission fluid. Change transmission fluid immediately after vehicle operation, before fluid cools. Change transmission fluid as follows:
 - (1) Remove transmission pan screws, pan and gasket.
 - (2) Remove and discard oil filter.
 - (3) Remove and discard O-ring seal from pick-up pipe.
 - (4) Install new O-ring seal on pick-up pipe and install filter and pipe assembly.
 - (5) Clean pan thoroughly and position new gasket on pan. Use petroleum jelly or equivalent to position gasket.
 - (6) Install pan using screws. Tighten screws to torque specified in table 6-2.
 - (7) Pour approximately 5 quarts of transmission fluid into filler pipe. Be sure container spout, funnel or other items in contact with fluid are clean.
 - (8) Start engine and allow it to idle a few minutes.
 - (9) Apply brake pedal and parking brake. Shift transmission into all positions, then return lever to NEUTRAL.
 - (10) With transmission at operating level, check fluid level. Add fluid, if necessary, to bring level to FULL mark.

4-4.11 Transfer Case Service. The following paragraphs contain procedures for checking the transfer case fluid level and for draining and refilling the transfer case. All maintenance procedures must be performed at scheduled intervals.

a. Checking and adding transfer case fluid.

- (1) Remove transfer case fill plug located on rear of transfer case.

- (2) Lubricant should be level with fill hole.
- (3) If fluid level is low before scheduled replacement interval, add transfer case fluid until filled to the appropriate level.

b. Draining and refilling transfer case.

- (1) Remove fill plug and drain plug.
- (2) Allow transfer case to drain completely.
- (3) Install drain plug and tighten to torque specified by table 6-2.
- (4) Add fluid to transfer case to just below level of fill hole.
- (5) Install fill plug and tighten to torque specified by table 6-2.

4-4.12 Propeller Shaft Service. The following paragraphs contain procedures for lubricating different parts of the propeller shaft to use multipurpose lithium base grease. All maintenance procedures must be performed at scheduled intervals.

WARNING

P-D-680 Type II is toxic to the skin, eyes, and respiratory tract. Avoid skin and eye contact. Good general ventilation is normally adequate.

NOTE

Undercoating or rustproofing compounds could unbalance the propeller shafts and cause drivetrain vibrations. Remove any such compounds using P-D-680 Type II.

a. Lubricating sleeve yoke (splines).

- (1) Apply grease gun pressure to sleeve yoke grease fitting until lubricant appears at pressure relief hole in expansion plug at sleeve yoke end of spline.
- (2) Cover pressure relief hole with finger, and continue to apply pressure until grease appears at sleeve yoke seal.

b. Cleaning and lubricating universal joint.

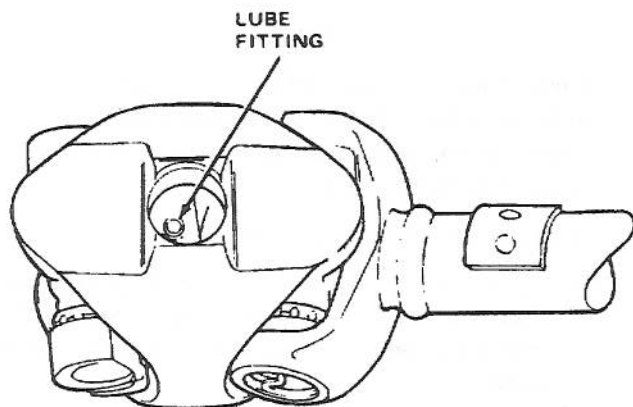
- (1) Raise vehicle on frame-contact type hoist (wheels must be free to rotate).
- (2) Clean dirt from around universal joint.
- (3) Lubricate universal joint (see figure 4-2).

4-4.13 Steering System Service. This paragraph contains procedures for inspecting the steering system. All inspections must be performed at scheduled intervals. Repair or replace components as required.

- a. Check steering components and grease seals for damage or wear.
- b. Check power steering gear assembly for leaks, housing cracks and loose frame mounting.
- c. Check steering damper for leaks or loose mounting.
- d. Check steering toe-in rods and connecting rod for bending, looseness or wear.
- e. Check power steering fluid level. If dipstick reads below FULL mark, add appropriate amount of fluid.

4-4.14 Differential Service. The following paragraphs contain procedures for checking, adding and changing differential fluid and for inspecting the differential for leaks. All maintenance procedures must be performed at scheduled intervals.

- a. Checking and adding differential fluid.
 - (1) Remove plug from differential.
 - (2) Check fluid level using finger. Fluid should reach level just below plug hole.



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Figure 4-2. U-Joint Lubrication Point

- (3) If low, add differential oil until lubricant reaches proper level.
- (4) Install plug.

b. Changing differential fluid.

NOTE

Before changing differential fluid, place a suitable container under differential to catch draining lubricant.

- (1) Operate vehicle for 5 minutes to warm differential fluid.
 - (2) Drain lubricant by removing cover plate.
 - (3) Replace cover plate and fill differential through plug hole to proper level.
 - (4) Operate vehicle for approximately 10 miles, making at least ten figure-eight turns to flush old lubricant out of clutch packs.
 - (5) Repeat steps 2 through 4 replacing cover gasket.
- c. Inspecting differential for leaks. Visually inspect differential body, junction of body and cover plate for signs of leaking fluid. Leaks may be the result of worn or damaged cover gasket. Repair as required.

4-4.15 Wheels and Tires Service. This paragraph contains procedures for checking, adjusting wheels and tires and for lubricating wheels. All maintenance procedures must be performed at scheduled intervals.

- a. Lubricating front wheel bearings. Refer to paragraph 5-5.7.7 for access to front wheel bearing, and lubricate the bearings as follows:

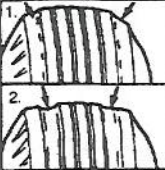
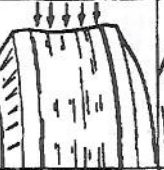


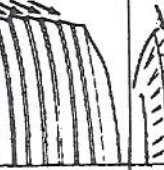

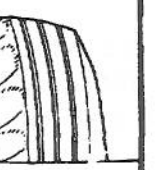
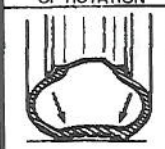
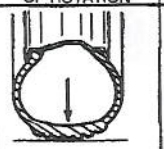
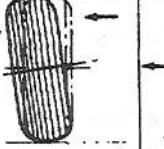
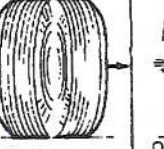
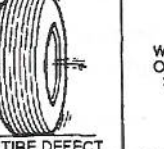
	RAPID WEAR AT SHOULDERS	RAPID WEAR AT CENTER	CRACKED TREADS	WEAR ON ONE SIDE	FEATHERED EDGE	BALD SPOTS	SCALLOPED WEAR
CONDITION							
CAUSE	UNDERINFLATION OR LACK OF ROTATION 	OVERINFLATION OR LACK OF ROTATION 	UNDERINFLATION OR EXCESSIVE SPEED	EXCESSIVE CAMBER 	INCORRECT TOE 	UNBALANCED WHEEL 	LACK OF ROTATION OR WORN OR OUT- OF-ALIGNMENT SUSPENSION
CORRECTION	ADJUST PRESSURE TO SPECIFICATIONS WHEN TIRES ARE COOL ROTATE TIRES		REPLACE TIRES	REPLACE FRONT AXLE HOUSING IF NECESSARY	ADJUST TOE-IN TO SPECIFICATIONS	DYNAMIC OR STATIC BALANCE WHEELS OR TIRE DEFECT	ROTATE TIRES AND INSPECT SUSPENSION

Figure 4-3. Tire Wear Patterns

CAUTION

Do not overfill wheel hub with grease. Leakage may occur, resulting in contamination of brake linings.

- (1) Pack bearings with lithium-based grease, as specified in figure 4-5. Be sure to force grease between rollers.
 - (2) Check bearing races for signs of pitting, brinelling or overheating. Refer to paragraph 5-5.7.7 and replace any damaged parts.
 - (3) Wipe spindle clean and apply small amount of grease.
 - (4) Wipe wheel hub clean and apply small amount of grease inside hub.
 - (5) Refer to paragraph 5-5.7.7 and reassemble wheel.
- b. Adjusting front wheel bearings.
- (1) Raise vehicle.
 - (2) Remove hub cap.
 - (3) Remove outer locknut and lockwasher.
 - (4) Seat bearings by loosening, then tightening, inner locknut to torque specified in table 6-2, using tool #J-6893. Rotate wheel while tightening locknut to seat bearings uniformly.
 - (5) Back off inner locknut 1/6 turn (45°-65°) while rotating wheel.
 - (6) Install lockwasher. Align a lockwasher hole with peg on inner locknut and install washer on nut.
 - (7) Install outer locknut. Tighten outer locknut to minimum of torque specified in table 6-2, using tool #J-6893.
 - (8) Recheck bearing adjustment. Wheel must rotate freely and not display any lateral movement.
 - (9) Install spring cup and pressure spring.

CAUTION

The spring cup must be installed so the recessed side faces the bearing and the flat side faces the pressure spring. The pressure spring should contact the flat side of the cup only.

- (10) Install drive gear snap ring.
- (11) Coat hub cap rim with Permatex Form-A-Gasket No. 3 and install hub cap.
- c. Checking for abnormal tire wear. Abnormal tire wear can be caused by incorrect inflation pressures, tire-wheel unbalance, worn suspension components, improper brake operation, bent wheels, front wheel misalignment or excessive speed on turns. Refer to figure 4-3 for symptoms and corresponding corrective actions.
- d. Adjusting tire inflation pressure. Standard tire pressure is 75 psi. Check and adjust inflation pressures only when the tires are cold, or driven for less than 2 miles at low speeds below 10 mph, or after the vehicle has been parked for 3 hours or more. Do not reduce inflation pressures if the tires are hot, or driven over 2 miles at speeds above 10 mph. At this stage, tire pressures may increase as much as 6 psi over cold inflation pressures due to air expansion caused by heat buildup in the tire. When checking and adjusting inflation pressures, always use a reliable and accurate gauge to ensure proper inflation levels.
- e. Inspecting tread. Visually inspect tires for any foreign objects lodged in tread. Remove any objects and make sure tire has not been damaged.
- f. Repairing tires. Punctured tires and/or tubes should be removed from the wheel and permanently repaired from the inside, using a combination repair plug and vulcanized patch. When repairing punctures, always follow the manufacturer's directions for repair kit instructions.

NOTE

Punctures in the tread area only are repairable on tubeless tires. Do not attempt to repair punctures in the tire shoulders or sidewalls. In addition, do not attempt to repair a tire that has bulges or blisters; ply separations; broken, cut or cracked beads; fabric cracks or cuts; bald spots; or visible wear indicators or punctures larger than 1/4 inch in diameter.

TIRE ROTATION

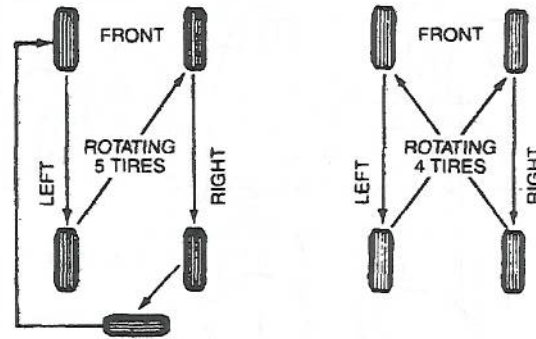


Figure 4-4. Tire Rotation

- g. Rotating tires. The first rotation is the most important in setting the stage for even tread wear. Rotate tires promptly at scheduled intervals and in a pattern shown in figure 4-4.
- h. Checking wheel-retaining nut tightness. Check the torque on all wheel retaining nuts. Make sure all nuts are tightened to torque specified by table 6-2.

4-4.16 **Frame Service.** Check structural members for cracks or signs of overload at scheduled intervals. Tighten all attaching hardware.

4-4.17 **Windshield Wiper Service.** Turn windshield wipers and washers on and check to see that wipers clean fluid off windshield without leaving streaks. Replace wiper blades if necessary. Check washer fluid reservoir level and refill if necessary. Maintenance procedures must be performed at scheduled intervals.

4-4.18 **Air System Service.** Maintenance procedures for all air system components must be performed at scheduled intervals as follows:

WARNING

Depressurize system before attempting any service or repair that requires disassembly of any pressurized components. Severe injury or death can result if system remains pressurized during any component removal.

- a. Replace the air filter element as follows:
 - (1) Disconnect air filter from air compressor.
 - (2) Remove filter element.
 - (3) Install new filter element.
 - (4) Install air filter on air compressor.

- b. Service the alcohol injector as follows:

WARNING

Methyol alcohol is flammable. Ensure ignition is off and engine is cool before draining and/or adding alcohol to the alcohol injector. Severe burns can result if engine is hot or the engine is left running.

- (1) Drain fluid using drain cock located under the alcohol injector.
 - (2) Close drain cock when all fluid has been drained. Remove screws holding reservoir to cover. Carefully remove reservoir from cover.
 - (3) Using a clean shop rag, clean any residue from the reservoir.
 - (4) Inspect the tetraseal for wear. Replace as necessary.
 - (5) Fill reservoir to fill mark with methyol alcohol.
 - (6) Attach reservoir to cover with screws.
- c. Adjust belt tension as necessary, to provide 1/2 inch of flex in middle of belt.

NOTE

During cold weather operation or service, the alcohol injector should be serviced first. Set the HEATER ON/OFF switch to the ON position and start the engine pressurizing the system. Let the engine warm up. Shut engine off, and set the HEATER ON/OFF switch to OFF position. Depressurize system.

- d. Drain fluid from system as follows:
- (1) Remove drain plugs from both heater drain valve assemblies.
 - (2) Allow fluid to drain from both assemblies.

- (3) Thread and tighten plugs to drain valve assemblies.

- e. Replace all worm pressure hoses and/or fittings.
- f. Pressurize system and check for leaks. Tighten fittings as necessary.

4-4.19 Winterization System Service. Maintenance procedures for all winterization system components must be performed at scheduled intervals as follows:

- a. Inspect coolant heater and hoses for leaks or signs of wear. Replace as necessary.
- b. Inspect oil thermostat and heater for leaks. Tighten or replace as necessary.
- c. Inspect all electrical wiring for corrosion, burned, frayed or broken wires, and/or loose electrical connections.
- d. Inspect seal on receptacle cover on front of vehicle for signs of wear. Replace seal or cover assembly as necessary.
- e. Inspect battery warmer for dirt and corrosion. Remove battery and clean and/or replace warmer as necessary.

4-5 LUBRICATION.

The lubrication chart, figure 4-5, lists all parts and areas requiring periodic lubrication, the types of lubricants required and the intervals between application. This information is presented through the use of symbols. These symbols are identified and explained in the lubricant key, which also contains special notes regarding some lubrication operations. Lubrication intervals given in this chart are appropriate for normal climatic conditions and must be shortened accordingly when the vehicle is operated under conditions of extreme heat, cold, dust or humidity. Details on the major lubrication procedures (such as engine crankcase, drain and refill) will be found under the appropriate heading in this section.

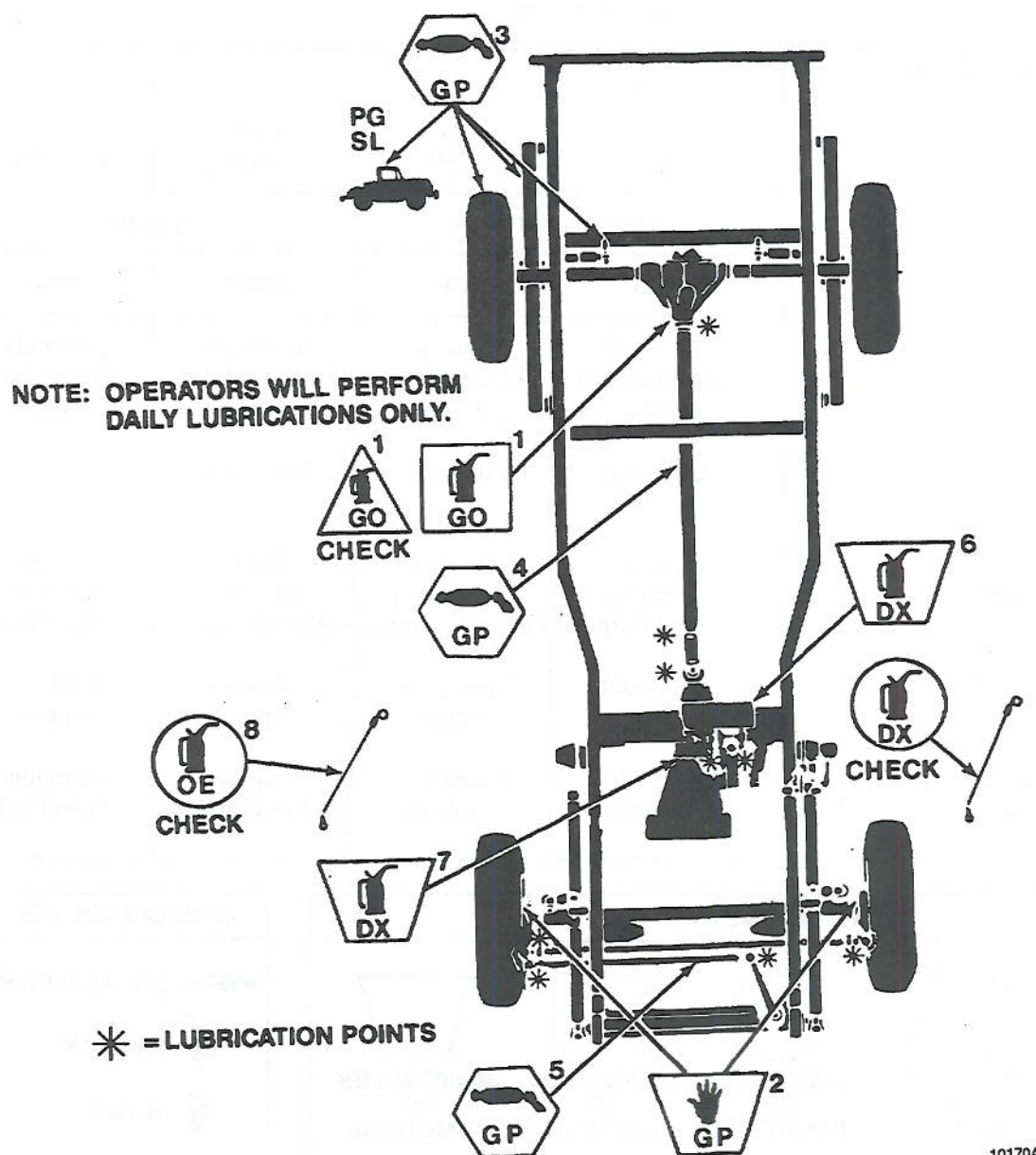

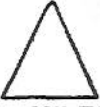








Figure 4-5. Lubrication Chart (Sheet 1 of 3)

Lubricant Key

Types of Lubricants & Symbols	30°C and up	-7°C to +25°C	+5°C to +40°C	-18°C to +10°C
Engine Oil, OE	15W40 or 20W/40		10W30	
	40W	30W	20W20	10W
DEXRON II, DX	Automatic Transmission Fluid	Automatic Transmission Fluid	Automatic Transmission Fluid	Automatic Transmission Fluid
Oil, Gear, GO SAE 80W-140	Oil, Gear	Oil, Gear	Oil, Gear	
Lithium-Based Chassis Lubricant, GP	Grease, Chassis General Purpose	Grease, Chassis General Purpose	Grease, Chassis General Purpose	Grease, Chassis General Purpose
3M Spray Lube 8902, SL	Lubricant, Spray	Lubricant, Spray	Lubricant, Spray	Lubricant, Spray
Powdered Graphite, AMC/JEEP Silicon Lubricant Spray or Light Oil, PG	Graphite, Powdered	Graphite, Powdered	Graphite, Powdered	Graphite, Powdered

INTERVAL KEY				
				
DAILY	2500 MILES OR 3 MONTHS	5000 MILES OR 6 MONTHS	12,000 MILES OR 12 MONTHS	30,000 MILES OR 30 MONTHS

APPLICATION KEY	
	GREASE GUN
	OIL CAN
	HAND

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Figure 4-5. Lubrication Chart (Sheet 2 of 3)

Lubrication Notes

1. Clean the lubrication fittings with dry cleaning solvent, Federal Specification P-D-680 Type II. Dry before applying lubricant.
2. Intervals specified are for normal operation. The maintenance office may adjust the intervals to compensate for unusual climatic or operating conditions.
3. Check axle differential fluid at 2500 miles or 3 months. Replace differential fluid at 30,000 miles or 30 months.
4. Lubricate every 12,000 miles or 12 months. Replace spindle oil and bearing seals on front wheel bearings (rear wheel bearings do not require periodic or scheduled lubrication).
5. Lubricate body components at 5000 miles or 6 months.
6. Lubricate propeller shafts at 5000 miles or 6 months. Lubricate sleeve yokes (spline and U-joints).
7. Lubricate steering linkage at 5000 miles or 6 months. Lubricate every 12 months or 12,000 miles.
8. Check transfer case fluid at 3 months or 2,500 miles. Replace fluid at 12,000 miles or 12 months.
9. Replace automatic transmission fluid at 12,000 miles or 12 months.
10. Change engine oil at 250 miles and every 1,000 miles afterward.

Figure 4-5. Lubrication Chart (Sheet 3 of 3)

Chapter 5

OVERHAUL PROCEDURES

5-1 GENERAL.

The purpose of this chapter is to present information, illustrations and procedural steps for the overhaul of all repairable assemblies.

5-2 SCOPE.

This chapter provides information of a general nature as well as specific overhaul procedures. These types of maintenance information are divided into the following two groups:

- (1) General Maintenance Procedures
- (2) Overhaul Procedures

5-2.1 General Maintenance Procedures. These procedures cover information that constitutes typical or standard shop practices involved in repair operations. Information under this heading will be presented in the following order:

- (1) General Removal Instructions
- (2) General Disassembly Instructions
- (3) General Cleaning Instructions

- (4) General Inspection Instructions
- (5) General Repair Instructions
- (6) General Reassembly and Installation Instructions

5-2.2 Overhaul Procedures. Overhaul procedures cover specific repair and/or overhaul procedures that can be performed on each subassembly or component. Information under this heading will be presented, as required, in the following order:

- (1) Removal
- (2) Disassembly
- (3) Repair and Replacement
- (4) Assembly
- (5) Test
- (6) Installation

5-3 CONSUMABLE MATERIALS.

The following table contains all consumable materials to be used in servicing the vehicle.

Table 5-1. Consumable Materials

Item	Nomenclature	Specification	Commercial Source
1.	Preservation Oil	Military Spec. MIL-0-8188 MIL-0-6083	
2.	Creosol Base Cleaning Compound	Military Spec. MIL-C-5546	
3.	Aircraft Cleaning Compound	Military Spec. MIL-C-25769	
4.	Rust Preventative	Military Spec. MIL-C-16173	
5.	1,1,1- Trichloroethane	Federal Spec. 0-T-620	
6.	Light Lubricating Oil	VV-L-800	
7.	Cleaning Solvent	Federal Spec. P-D-680 Type II	

Table 5-1. Consumable Materials-Continued

Item	Nomenclature	Specification	Commercial Source
8.	Sodium Carbonate	Federal Spec. O-S-571	Part No. TL-102 for Paint, Item Bostic-Finch Inc. FSCM 98502
9.	Soap Chips	Federal Spec. P-S-579	
10.	Fluorescent Penetrant	Military Spec. MIL-T25135	
11.	Paint Thinner	Military Spec. MIL-T-81772	
12.	Fingerprint Remover Compound	Military Spec. MIL-C-15074	
13.	Corrosion Preventative Compound	Military Spec. MIL-C-6529	
14.	Antiseize Compound	Military Spec. MIL-T-5544	
15.	Pipe-Joint Nonhardening Compound		
16.	Mineral Oil		
17.	Isopropyl Alcohol	TT-I-735	
18.	Rosin Core Solder	ASTM B 284-79	
19.	Lubricant		
20.	Teflon Tape		
21.	Petroleum Jelly		
22.	Chassis Grease		
23.	Loctite 271 Adhesive/Sealant		RTV732 Dow Corning FSCM 71984
24.	Silicone Sealer		
25.	General Purpose Grease	Military Spec. MIL-G-18709	

Table 5-1. Consumable Materials-Continued

Item	Nomenclature	Specification	Commercial Source
26.	Gear Lubricant, SAE 80W-140		
27.	Brake Fluid		
28.	Silicone Lubricant		
29.	Wheel Bearing Grease		
30.	Exterior Spray Paint		
31.	Spray Lubricant		
32.	Bedding and Glazing Compound		
33.	General Purpose Adhesive Cleaner		
34.	Green Paint	Federal Spec. 595	Color No. 24052

5-4 GENERAL MAINTENANCE PROCEDURES.

In addition to procedures for each repairable assembly, this chapter includes general instructions under each of the headings. These instructions apply to all procedures in this manual and no references will be made to them in other procedures. When general instructions are adequate, no reference will be made to those particular operations under the component heading. In addition, Table 5-1 provides a list of consumable materials.

5-4.1 General Removal Instructions. Before removing any part, check the testing and troubleshooting data to determine if the trouble is actually in the component. Also, carefully observe the following procedures.

5-4.1.1 System Depressurization. Make sure the system is not energized or pressurized. Disconnect the battery ground cable; relieve all pressure from the hydraulic system and air system. Be sure all controls are in the OFF position before starting any removal procedure.

5-4.1.2 Clearance. Ensure that adequate clearance exists for removal of the component. Remove adjacent components if necessary to provide adequate working clearance.

5-4.1.3 Lifting Devices. Use a chain hoist, jack or other aid when lifting heavier components.

5-4.1.4 Identifying Parts. To facilitate reassembly and installation, apply identifying tags to mating ends of

electric and hydraulic lines as they are removed or disconnected.

5-4.1.5 Valves. Carefully note or diagram the relationship of valve actuating handles to the body in open and closed position before disassembling these units. At reassembly, make certain that the original relationship is restored.

5-4.1.6 Salvage. Assemblies that are removed, even though defective, should be saved for possible reclamation or salvage.

5-4.2 General Disassembly Instructions. The following disassembly instructions apply to all procedures in this chapter. Keep the work area clean to avoid contamination of the internal parts. This is especially important for control valves, cylinders, or hydraulic system components.

5-4.2.1 Tools. Do not use any metal tool when removing gaskets, packings, or seals to avoid scratching the sealing surfaces. Use a pointed wooden dowel to remove packings from their grooves. Use wooden or plastic scrapers on gasket surfaces.

5-4.2.2 Use of Illustrations. Before disassembly of any item, study the exploded view illustration carefully, paying particular attention to the relationship of internal parts.

5-4.2.3 Identifying Parts. To facilitate reassembly and installation, apply identifying tags to mating ends of electric and hydraulic lines when they are

disconnected. Identify parts of similar configuration to ensure correct reassembly.

5-4.2.4 Storage of Removed Parts. To prevent moisture and foreign matter from entering open housings, lines and other openings, apply protective covers after disassembly. Wrap all parts in clean paper or dip parts in preservation oil (1, table 5-1).

5-4.2.5 Limiting Removal of Parts. Remove only the parts requiring repair or replacement. Do not disassemble a component any further than is necessary.

5-4.3 General Cleaning Instructions. Where instructions call for solvent, use Federal Specification P-D-680 Type II (2, table 5-1) in tanks or spray booth. Do not use gasoline for cleaning. Prior to removal from the truck, the exterior parts of the equipment should be thoroughly cleaned to remove accumulated mud, tar and grease. This procedure will facilitate inspection and disassembly. Use a vapor pressure spray rinse cleaner to clean exterior parts. The following warnings apply to these general cleaning instructions.

WARNING

Spray booth operations must be approved by local biocenvironmental engineer prior to operating.

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi and goggles are required.

P-D-680 Type II is toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Good general ventilation is normally adequate.

1,1,1-Trichloroethane is toxic to skin, eyes, and respiratory tract. Avoid prolonged or repeated skin contact. Assure adequate ventilation.

5-4.3.1 Removal of Solvent After Soaking. After soaking parts in solvent, wash away deposits by slushing or spraying and, where necessary, by brushing with a soft-bristle brush (not wire) moistened in the solvent. Use a jet of dry compressed air to dry parts, except bearings, after cleaning. Bearings must be allowed to drip and air dry.

5-4.3.2 Removal of Carbon Deposits. To remove carbon deposits from metal parts, soak parts for at least 75 minutes in a heated mixture of one part creosol base cleaning compound (2, table 5-1) and four parts water. The solution container should be equipped with an ex-

haust system to expel fumes and should be able to heat the solution to 140°F. Avoid skin and eye contact with aerosol solution.

5-4.3.3 Dilution of Carbon Cleaning Solution. All parts that have been soaked in carbon removal solution should be rinsed with cleaning solvent (7, table 5-1). Rinsing should be accomplished in a solvent spray booth equipped with filter and hand spray gun. After soaking, use a soft-bristle brush to remove carbon deposits. A cloth buffing wheel may also be used.

CAUTION

Do not clean tires, lubricant seals, rubber hose or electrical components with cleaning solvent.

WARNING

Aircraft cleaning compound (MIL-C-25769) and P-D-680 Type II are toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Good general ventilation is normally adequate.

5-4.3.4 Aircraft Cleaning Compound. Use aircraft cleaning compound (3, table 5-1), one part compound with four to nine parts cleaning solvent (7, table 5-1), for cleaning rubber, plastic and rubber components. Allow compound to remain on item surface for about 10 minutes before rinsing. Rinse with hot or cold water under pressure. If available, use hot water under 80 to 120 pounds pressure. An ordinary garden hose with nozzle may be used if other equipment is not available. Rinse thoroughly. Aircraft cleaning compound is suitable for rubber or plastic items.

5-4.3.5 Use of Tools in Cleaning. Do not use scrapers, wire brushes, abrasive wheels or compounds in cleaning parts, unless these procedures are specifically approved in the detailed instructions. These procedures normally alter the dimensional characteristics of machined surfaces and may weaken a highly stressed part.

WARNING

Rust preventative (MIL-C-16173) is flammable and toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Keep away from open flames and other ignition sources. Good general ventilation is generally adequate.

CAUTION

To prevent corrosion, parts should be dipped in rust preventive (4, table 5-1) within 2 hours of degreasing.

5-4.3.6 Use of Degreasing Machine. A degreasing machine may be used to remove heavy grease and oil from metal parts. 1,1,1-Trichloroethane, Federal Specification O-T-620 (5, table 5-1), is used as a degreasing agent.

5-4.3.7 Bearings. When cleaning ball or roller bearings, place them in a basket and suspend them in a container of cleaning solvent (7, table 5-1); soak as required. If necessary, use a brush to remove caked grease, chips, etc. Avoid rotating the bearings before solid particles are removed. When bearings have been cleaned, spin them immediately in light lubricating oil (6, table 5-1) to remove solvent.

5-4.3.8 Preformed Packings. Do not clean preformed packings or other rubber parts in cleaning solvent. These parts should be wiped clean with a clean, dry, lint-free cloth.

WARNING

Make sure that spray cleaning operation has been evaluated or reviewed by the local bioenvironmental engineer.

5-4.3.9 Oil Passages. On removal of parts from degreasing machine and immediately prior to coating with rust preventive, check all oil passages and cavities for cleanliness and freedom from obstructions. A thin, flexible wire should be run through oil passages to make certain that they are not clogged. Using a pressure spray gun and cleaning solvent, clean dirty passages.

CAUTION

Do not use soap or alkalies to clean tank interiors.

5-4.3.10 Tanks and Reservoirs. Oil and fuel tanks and similar reservoirs should be flushed, using a spray gun and cleaning solvent (7, table 5-1).

WARNING

Steam or vapor pressure cleaning creates hazardous noise levels and severe burn potential. Eye, skin and hearing protection are required.

5-4.3.11 Cooling System. The cooling system radiator core should be cleaned with steam or hot water. If sediment cannot be completely removed by this method,

boil the core in a solution of sodium carbonate and water. Use a solution of 1 pound of sodium carbonate (8, table 5-1) to each gallon of water. Flush with clean hot water or steam.

5-4.3.12 Electrical Parts. Electrical parts, such as coils, junction blocks and switches, should not be soaked or sprayed with cleaning solutions. Clean these parts with a clean lint-free cloth moistened with cleaning solvent (7, table 5-1).

5-4.3.13 Batteries. Clean electrical system battery exterior with a weak solution of baking soda and water. Apply the solution with a bristle brush to remove any corrosive buildup on the battery cable clamps, terminals and battery tray. Rinse thoroughly with fresh water.

5-4.3.14 Exterior of Vehicle. Wash painted surfaces of truck with a solution of 1/4 pound of soap chips (9, table 5-1) to 1 gallon of water.

5-4.4 General Inspection Instructions. Inspection consists of checking for physical distortion, wear, cracks and pitting and of checking dimensions of parts for compliance with requirements of the Table 6-1, Table of Limits. Parts subjected to heavy load pressure must be thoroughly inspected by performing surface temper, magnetic particle or fluorescent penetrant procedures where necessary. Clean all parts before inspection.

NOTE

Defects which may cause bearing binding or misalignment are cause for rejection. Nicks or gouges outside race load areas are not cause for rejection.

The following inspection procedures apply to all sub-assemblies and parts on the vehicle.

5-4.4.1 Sealing Surfaces. Inspect all surfaces in contact with gaskets, packings or seals for nicks, burrs, scratches, etc., which might damage the new seals upon reassembly. If any defect is found, remove it, as outlined under "General Repair Instructions" before reassembly.

5-4.4.2 Bearings. Examine bearings for rusted or pitted balls, races or separators. Examine balls and races for brinelling, abrasion and serious discoloration. The following are causes for bearing rejection:

- (1) Cuts or grooves parallel to ball or roller rotation.
- (2) Fatigue pits (as opposed to minor machine marks or scratches).
- (3) Cracks detected during magnetic particle inspection.

5-4.4.3 Drain Plugs. When removing drain plugs from engine system components, inspect the sediment adhering to the plug. Accumulations of grit or fine metal particles may indicate actual or potential component failure. A few fine particles are normal. This inspection is effective in determining defective parts before internal inspection of the component.

5-4.4.4 Gears. Parameters for rejection of gears by visual inspection are not listed because of varying conditions for gear application. The following descriptions of wear conditions may help to determine when parts are defective.

- (1) Normal wear loss of metal from surface of gear tooth resulting from unavoidable abrasion, but to a degree that prevents gear from performing satisfactorily.
- (2) Initial pitting - pitting that may occur when gears are first started in service. It may continue only to a stage when local high spots have been worn down so there is still enough contact area to carry load without further impairment. This pitting is not necessarily serious.
- (3) Destructive pitting - pitting that continues to progress after initial period of operation, and to such a degree, that there is not enough contact area remaining to carry the load. Rapid destruction may occur from continued operation.
- (4) Abrasive wear - surface damage caused by fine particles carried in lubricant or by particles imbedded in tooth surfaces. Particles may be metal detached from gear tooth or bearings, abrasives not completely removed before assembly, sand or scale from castings, or other impurities in oil or surrounding atmosphere.
- (5) Slight scoring (scuffing, seizing, galling, etc.) minor impairment of surface, or a welding nature, showing slight tears and scratches in direction of sliding. It starts in area having high combination of surface stress and sliding velocity. It usually occurs at or near the tip of the tooth.
- (6) Burning - discoloration and loss of hardness from excessive temperature. This is caused by friction resulting from overload, overspeed, lack of backlash or faulty lubrication. If discoloring can be wiped off with clean cloth, such discoloring usually can be traced to oil-burn stains which are not serious.
- (7) Rolling - form of plastic yielding (continuous and permanent deformity in any direction without rupture). This results from heavy, even loads and from sliding.

NOTE

If visual inspection indicates that the gears are unserviceable, perform surface temper or magnetic particle inspection, or both.

5-4.4.5 Shafts and Splines. Inspect shaft splines for wear, pitting, rolling or peening and for fatigue cracks. In many instances, the same inspection procedure will apply as for gears. The condition, if still present, will usually be much less pronounced. When serviceability of splines is doubtful, perform a magnetic particle inspection.

5-4.4.6 Hoses and Tubing. Check all hose surfaces for broken or frayed fabric. Check for breaks caused by sharp kinks or contact with other parts of the truck. Inspect copper tubing lines for kinks. Inspect the fitting threads for damage. Replace any defective part. Following reassembly and during initial truck operation period, check for leaks.

5-4.4.7 Wiring Harness. Inspect all wiring harnesses for chaffed or burned insulation. Inspect all terminal connectors for loose connections and broken parts.

5-4.4.8 Castings and Weldments. Visually inspect all castings and weldments for cracks. Parts under great stress may be inspected further, using the magnetic particle inspection method. Critical nonferrous parts may be fluorescent penetrant-inspected.

5-4.4.9 Steel Components. A magnetic particle inspection may be performed on steel parts which are not 100 percent replaceable. Such steel parts that have been reworked or reground, or parts containing areas where fatigue can be expected, may be tested. Shear sections and reground contact surfaces shall show no defects. Any evidence of cracks is cause for rejection. Since some stainless steel materials cannot be magnetized, do not perform this inspection on such parts. This inspection shall be performed on all parts as specified in Military Specification MIL-I-6870 and MIL-I-6868 inspection requirements by qualified operators and inspectors. Equipment maintenance and operations shall be in accordance with Military Specification MIL-M-6867. On completion of inspection, pass parts through a demagnetizing field. Then wash and airblow dry.

5-4.4.10 Foreign Bodies. Parts shall be rejected if there are indications of nonmetallic foreign bodies gaseous, liquids, or solids longer than 1 inch; if all indications total more than 2 inches; or if indications total less than 1/8 inch apart. Parts shall also be rejected if the following patterns appear:

- (1) Bursts - scattered, short sharp lines. Bursts are

caused by high temperatures. Such discontinuities usually are internal and are seldom detected by magnetic particle inspection until the surface is cut to burst area.

- (2) Flakes - separate short wavy lines, usually in same general direction. Flakes are caused by improper cooling. Such discontinuities are usually internal and are seldom detected by magnetic particle inspection until surface is cut to flake area.
- (3) Grinding cracks - fine sharp lines, tightly packed. In some surfaces, cracks may be shallow and hard to see. Grinding cracks are usually caused by a glazed wheel. Instead of cutting, wheel rubs surface and overheats parts. Such discontinuities are thermal cracks similar to heat-treat and hardening cracks. Grinding cracks also may be caused by too little coolant, too much feed or too much speed.

WARNING

Fluorescent penetrant (10, table 5-1) may cause personal injury. Avoid skin contact. In case of skin contact, wash with warm water and soap.

5-4.4.11 Fluorescent Penetrant Inspection. A fluorescent penetrant inspection may be performed on non-steel metallic parts if deemed necessary. Some stainless steel materials cannot be magnetized; perform fluorescent penetrant inspection on such parts. After fluorescent penetrant (10, table 5-1) has been applied and pattern has developed, any evidence of cracks is cause for rejection. This inspection shall be performed on all parts, as described in Military Specification MIL-I-6870, by operators and inspectors certified in accordance with MIL-C-25343 (USAF), as required by Military Specification MIL-I-6870. Equipment maintenance and operations shall follow Military Specification MIL-I-6866.

5-4.5 General Repair Instructions. The following general repair instructions should be followed when working on, or overhauling, any assembly on the vehicle.

5-4.5.1 Gear Teeth. Remove burrs from gear teeth with a fine-cut file or hand grinder.

5-4.5.2 Starter Commutator. Starter commutator may be polished in a lathe, using a strip of 00 sandpaper.

After polishing, blow all dust and residue from commutator with compressed air.

CAUTION

Precautions should be taken to guard other parts of the vehicle from abrasive dust. Do not work near exposed parts and openings which would allow the dust to reach working parts.

5-4.5.3 Refinishing. Chassis and exterior painted parts may be resurfaced where paint is damaged, or where parts have been repaired, by using an abrasive disc.

5-4.5.4 Bearings. Remove residue and oil stain from bearing races with crocus cloth.

WARNING

Paint thinner is flammable and toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Keep away from open flame or other ignition sources. Good general ventilation is usually adequate.

5-4.5.5 Preparation of Surfaces for Painting. Before resurfacing, scrape loose any blistered paint from damaged areas. Sand or buff area to be painted. Remove any residual cleaning material with paint thinner (11, table 5-1) and dry thoroughly.

NOTE

Polished and machined steel parts are not protected by cadmium, tin, copper or other plating or surface treatment. Bare metal surfaces must be free of moisture. Acid from perspiration and skin oils may attack steel surfaces if fingerprints are not removed. Dip parts in fingerprint remover compound (12, table 5-1) after handling to prevent such action.

5-4.5.6 Preservation of Steel Parts. Bare steel surfaces shall be protected from oxidation while awaiting any repair step, reinspection or reassembly by dipping the parts in, or spraying them with, corrosion preventive compound (13, table 5-1). The same protective coating shall be applied to other metal parts in accordance with prevailing climatic or atmospheric conditions. Aluminum parts may require protection in high salt atmospheres. Steel parts must be protected in all instances.

WARNING

Welding and brazing operations produce heat, toxic fumes, radiation, metal slag and carbon particles. Welding and brazing goggles with the proper tinted lens are required. Also, gloves, apron and welding boots are required.

5-4.5.7 Welding and Brazing. Welding and brazing processes may be used to repair cracks in external steel parts, such as brackets, panels and light framework. However, the time required, the difficulty of working with the metal, and the chance of embrittlement and subsequent failure make such repairs of questionable value. Hence they should be attempted only when replacement parts are not available. Welding and brazing of castings and running parts or parts under great stress is not permissible, except in emergencies.

5-4.5.8 Stud Installation. When installing studs in engine block and axle housings, use a proper driver. A worn stud driver may damage the end thread, making it necessary to use a chasing die before a nut can be screwed on. This procedure will remove cadmium plating and allow corrosion, which will make future disassembly difficult, and will cause the stud to be backed out with nut. Before driving a stud, inspect hole for chips and liquid. Blow out any foreign matter. Start stud by hand. If it will not start into hole, it is too large or has a defective end thread. Before final insertion, coat thread with a film of antiseize compound (14, table 5-1). Turn stud in slowly to prevent overheating and galling of casting metal. Drive stud to proper "setting height", which is the total projecting length. While driving, observe torque required. This must be greater than nut tightening torque for same size, but not enough to damage casting as stud approaches its correct engagement depth.

5-4.5.9 Electrical Wiring. Replace all broken, worn or burned electrical wiring. Wires with several broken strands must be replaced. Broken strands increase the resistance of the wire and impair efficiency of the electrical components, especially the ignition system.

5-4.5.10 Hydraulic Lines and Hoses. Replace all broken, frayed, crimped or soft flexible lines and hoses. Replace fittings which are stripped or damaged. Replace entire flexible hose if fittings are damaged. Make sure the hose clamps do not crimp hoses.

5-4.5.11 Thread Repair. Replace any bolt, screw, nut or fitting with damaged threads. Inspect tapped holes for thread damage. At times, merely chasing the threads

with the proper size tap or die will be adequate. If cross-threading or spalling is evident, retap the hole for the next oversize screw or stud. When retapping will result in weakening the part, or when the cost of the part makes retapping impractical, replace the damaged part.

WARNING

Drilling operations are hazardous to the eyes. Eye protection is required.

5-4.5.12 Body Repair. Straighten minor body dents by bumping with a soft-faced hammer while using a wooden block backing. Repair minor skin cracks by installing patches according to standard shop practice. Reshape elongated mounting holes to round. Drill to receive bushing with required inner diameter. Stake bushing in place with center punch.

5-4.5.13 Air Hoses. Replace all broken, frayed, crimped or soft hoses. Replace fittings which are stripped or damaged. Replace entire hose if fittings are damaged.

5-4.6 General Reassembly and Installation Instructions. Before installing any item according to the following procedures, be sure parts are clean and protective grease coatings on new parts are removed.

5-4.6.1 Mandatory Replacement Parts. Whenever possible, replace all gaskets, packings and seals removed during repair work. Similarly all lockwire, lockwashers, cotter pins and like items should be replaced at time of reassembly.

5-4.6.2 Installing Preformed Packings. To replace a preformed packing, first dovetail groove, then stretch packing and place into position. Rotate component on flat surface and apply a downward pressure to uniformly press the packing into position.

5-4.6.3 Pipe Fittings. Use pipe-joint nonhardening compound (15, table 5-1) or teflon tape (20, table 5-1) when joining pipe fittings.

5-4.6.4 Installation of Oil Seals. Install oil seals with seal lip facing in, applying an even force to the outer edge of seal. Coat oil seals evenly with oil or grease before installing. If oil seals are to be installed over keyed or splined shafts, use a guide to prevent sharp edge of the keyway of splines from cutting the leather and neoprene seal. Guides can be constructed of very thin gauge sheet metal and shaped to the required diameter. However, make certain the guide edges are not sharp and are bent slightly inward so they do not cut the seal.

5-4.6.5 Installation of Bearings. When mounting bearings on shafts, always apply force to the inner races. When mounting bearings into housing, always apply the force to the outer race.

5-4.6.6 Lubrication of Preformed Packings. Lubricate all preformed packings with a thin coat of mineral oil (16, table 5-1) before installation.

5-4.6.7 Lubrication of Bearings. Lubricate bearings before reassembly with the lubricant normally used in the related housing or container. This will provide lubrication during the first run-in until lubricant from the system can reach the bearings.

5-4.6.8 Use of Identification Data in Installation. Refer to identifying tags and sketches made at removal to assist in installation of parts.

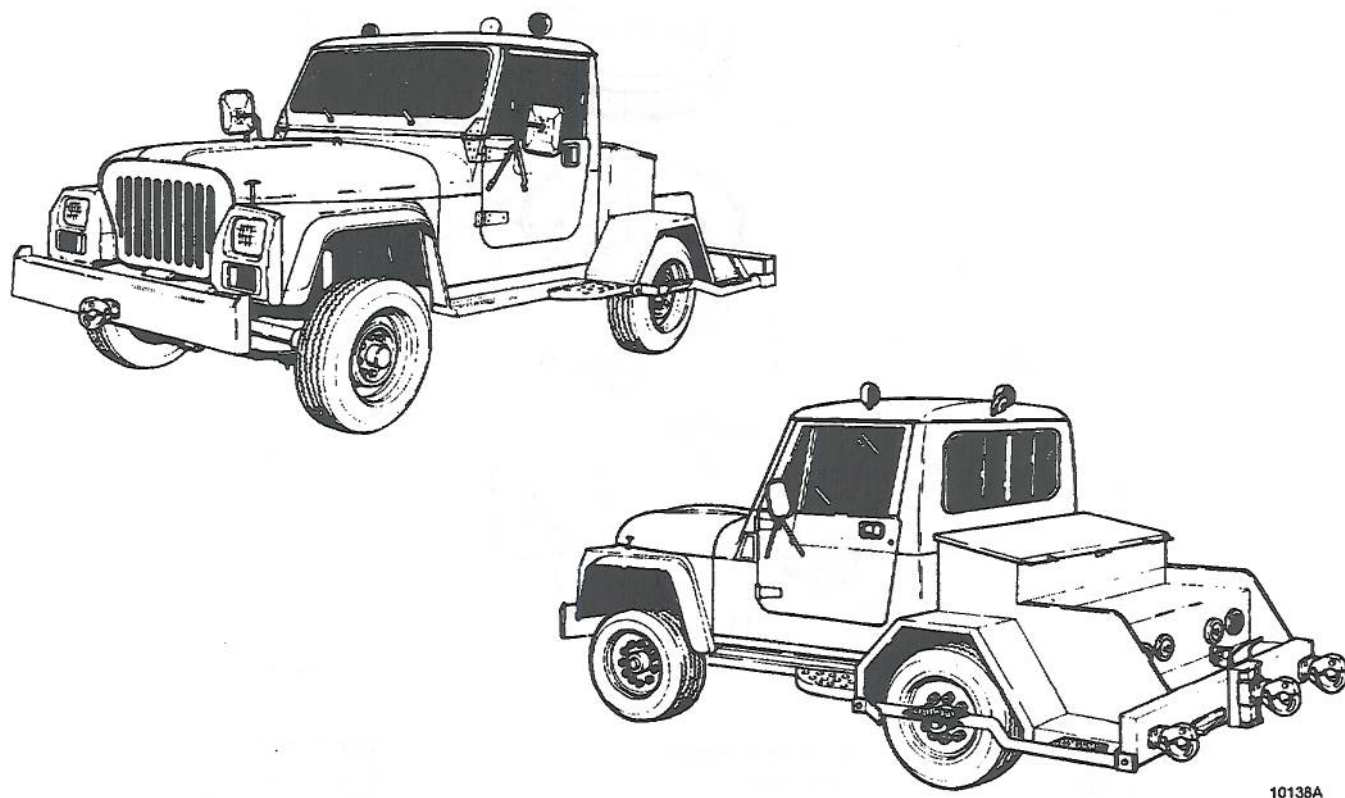
5-4.6.9 Testing. Test operation of parts after installation. Inspect for leaks, vibration, noise, misalignment, etc. Recheck after a few days operation.

5-5 OVERHAUL PROCEDURES.

The following paragraphs contain overhaul procedures for systems and components of the vehicle. The major assemblies are covered by the following groups of procedures:

- (1) Engine (paragraph 5-5.1)
- (2) Transmission (paragraph 5-5.2)
- (3) Transfer Case and Propeller Shaft (paragraph 5-5.3)
- (4) Steering (paragraph 5-5.4)
- (5) Front Axle and Suspension (paragraph 5-5.5)
- (6) Rear Axle and Suspension (paragraph 5-5.6)
- (7) Brakes and Wheels (paragraph 5-5.7)
- (8) Frame (paragraph 5-5.8)
- (9) Body (paragraph 5-5.9)
- (10) Cab Interior (paragraph 5-5.10)

Figure 5-1 shows the general location of each of the ten preceding major assemblies. Refer to the Table of Contents to find the desired component coverage.



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Figure 5-1. Flightline Tow Tractor, Model No. 3

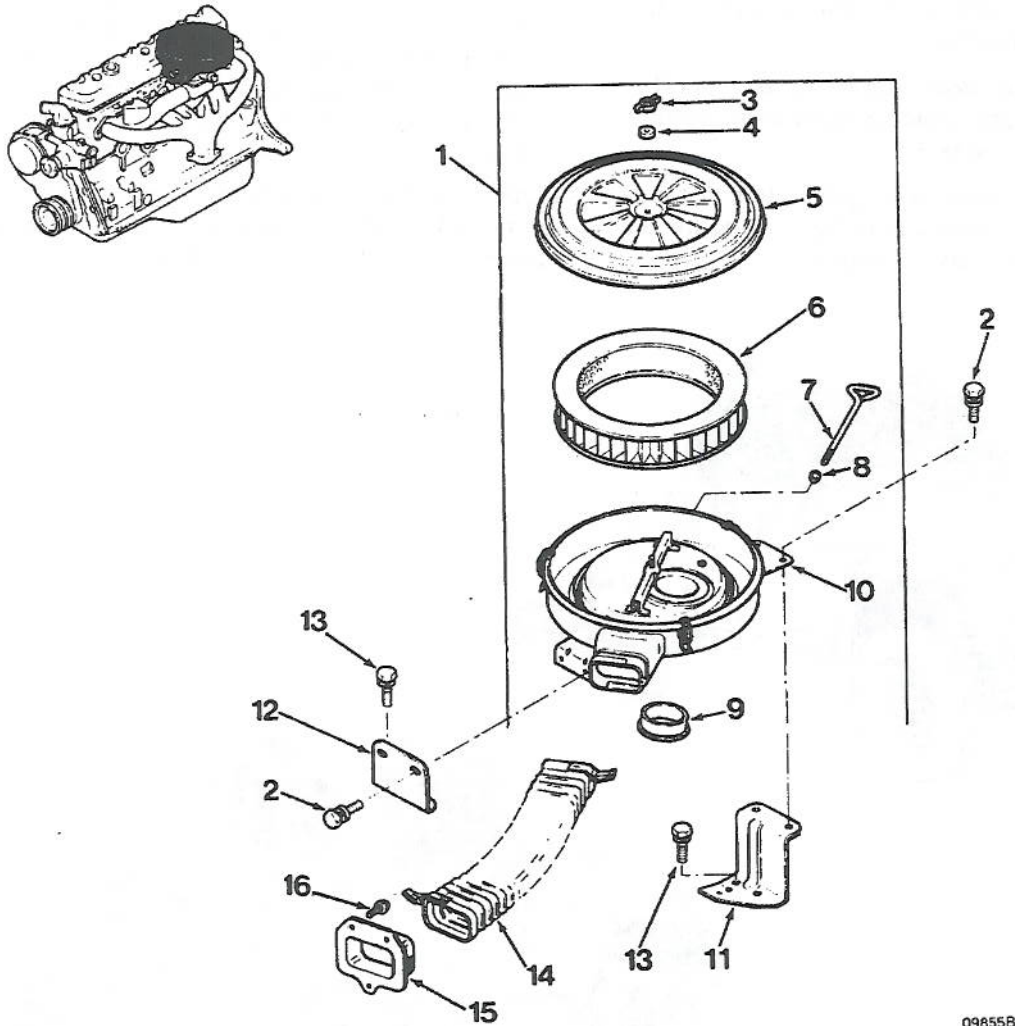
5-5.1 *Engine.* The following procedures are for components that make up the engine assembly. These components are mounted on or near the engine assembly or are needed to allow engine operation as provided in the following paragraphs.

5-5.1.1 *Air Filter Assembly and Duct Group.* Refer to figure 5-2, and perform the following steps to overhaul the air filter assembly and duct group.

a. Removal and disassembly. Remove and disassem-

ble the air filter assembly and duct group as follows:

- (1) Remove capscrews (16) and air intake adapter (15).
- (2) Remove screws and washers (2) from front support (12).
- (3) Remove screws and washers (2) from rear support (11).



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- | | | |
|-------------------------|-----------------------------------|------------------------------|
| 1. Air Cleaner Assembly | 6. Element Assembly | 11. Rear Support |
| 2. Screw and Washer | 7. Band Bolt | 12. Front Support |
| 3. Wing Nut | 8. Band Bolt Grommet | 13. Screw and Washer |
| 4. Wing Nut Packing | 9. Air Cleaner Mounting Insulator | 14. Air Intake Duct Assembly |
| 5. Cover Assembly | 10. Air Cleaner Body | 15. Air Intake Adapter |
| | | 16. Capscrew |

Figure 5-2. Air Filter Assembly and Duct Group

- (4) Remove wing nut (3), wing nut packing (4) and cover assembly (5).
 - (5) Remove element assembly (6).
 - (6) Remove band bolt (7) and band bolt grommet (8).
 - (7) Remove air cleaner body (10) from engine.
 - (8) Remove air cleaner mounting insulator (9).
 - (9) Remove air intake duct assembly (14) from air cleaner body (10).
 - (10) Remove screws and washers (13) and front support (12).
 - (11) Remove screws and washers (13) and rear support (11).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, clean and inspect the following:
- (1) Inspect air cleaner body (10), cover assembly (5), front support (12), rear support (11) and wing nut packing (4) for damage.
 - (2) Inspect air intake duct assembly (14) for damage or obstructions.
 - (3) Check element assembly (6) maintenance schedule.

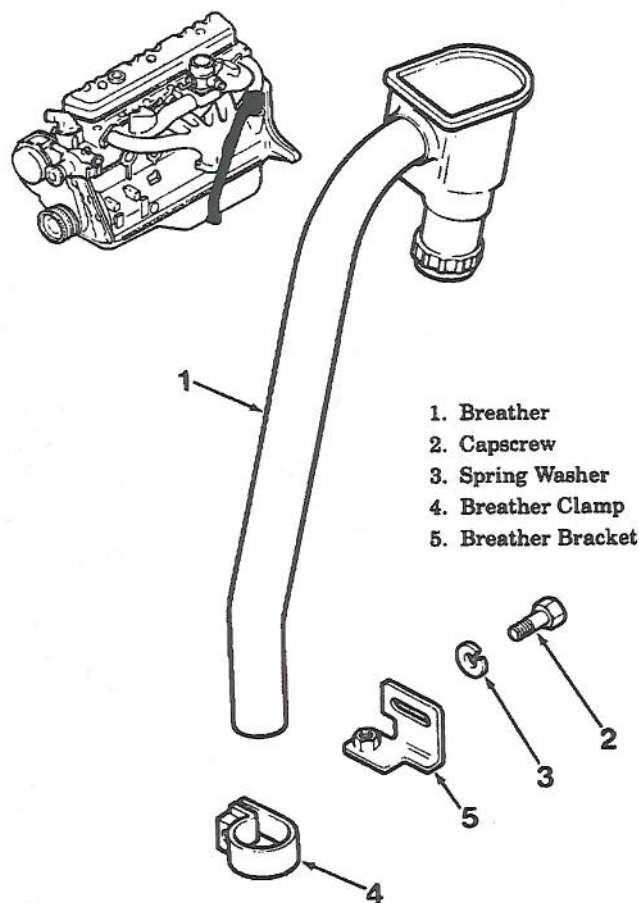
WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi. Eye protection is required.

- (4) Clean serviceable element assembly (6) with compressed air blown through element assembly (6) in direction opposite normal airflow.
- c. Repair and replacement. Replace all worn or damaged parts. Replace element assembly (6) at scheduled maintenance time or if extremely dirty or damaged. Refer to table 4-2 for maintenance schedule.
- d. Assembly and installation. Assembly is accomplished during installation. Install the air filter assembly and duct group as follows:
- (1) Install screws and washers (13) and rear support (11) on engine.
 - (2) Install screws and washers (13) and front support (12) on engine.
 - (3) Install air intake duct assembly (14) on air cleaner body (10).

- (4) Install air cleaner mounting insulator (9).
- (5) Install air cleaner body (10).
- (6) Install band bolt (7) and band bolt grommet (8) on air cleaner body (10).
- (7) Install element assembly (6).
- (8) Install cover assembly (5), wing nut packing (4) and wing nut (3).
- (9) Install screws and washers (2) through air cleaner body (10) to rear support (11).
- (10) Install screws and washers (2) through air cleaner body (10) to front support (12).
- (11) Install air intake adapter (15) and capscrews (16).
- (12) Connect air intake duct assembly (14) to air intake adapter (15).

5-5.1.2 *Positive Crankcase Ventilation System*. Refer to figure 5-3, and perform the following steps to overhaul the PCV system.



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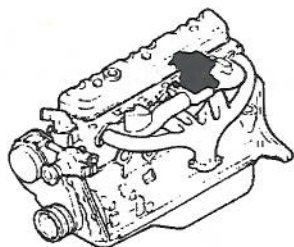
Figure 5-3. Positive Crankcase Ventilation System

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the PCV system as follows:
 - (1) Remove breather clamp (4) from breather (1) hose.
 - (2) Remove capscrew (2), spring washer (3) and breather bracket (5).
 - (3) Remove breather (1).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures.
- c. Repair and replacement. Replace all defective parts.

- d. Assembly and installation. Assembly is accomplished during installation. Install as follows:
 - (1) Install breather bracket (5) and breather (1).
 - (2) Install spring washer (3) and capscrew (2).
 - (3) Install clamp (4) on breather (1) hose.

5-5.1.3 *Venturi and Dashpot Assembly Group.* Refer to figure 5-4, and perform the following steps to overhaul the venturi and dashpot assembly group.

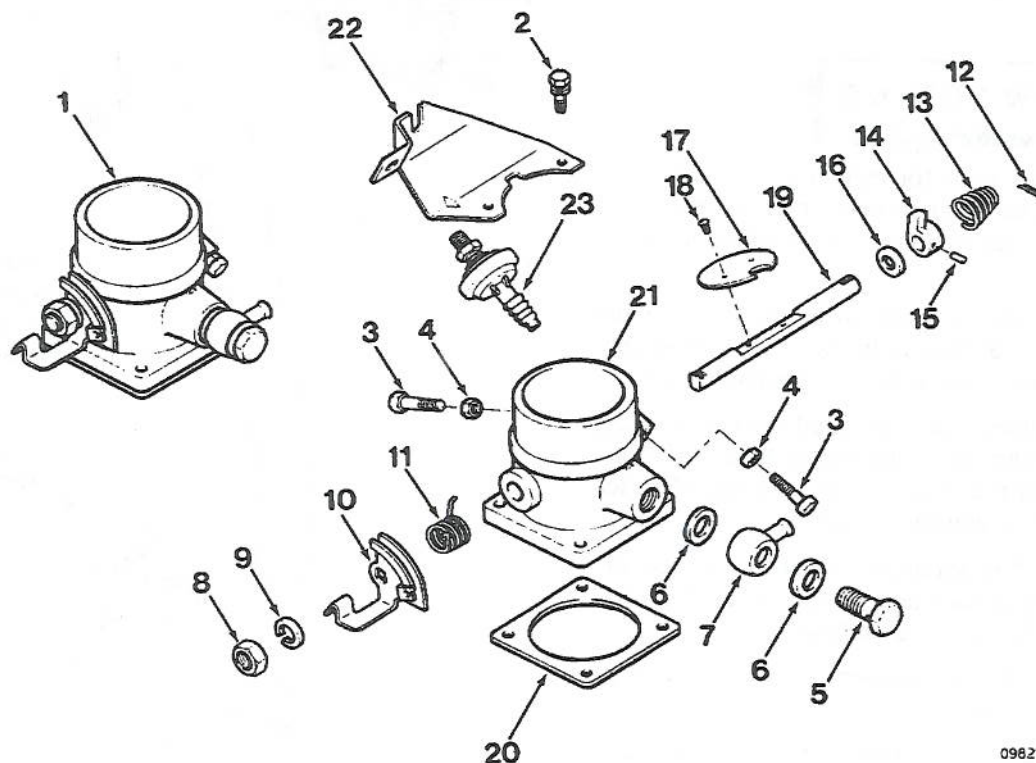
- a. Removal. Remove the venturi as follows:
 - (1) Disconnect accelerator linkage from accelerator wire bracket (22).
 - (2) Remove vacuum hose from hose joint (7).



1. Venturi Assembly
2. Screw and Washer
3. Lever Stop Screw
4. Hex Nut
5. Pipe Joint Screw
6. Gasket
7. Hose Joint

8. Hex Nut
9. Spring Washer
10. Control Lever
11. Lever Spring
12. Split Pin
13. Spring
14. Valve Stopper
15. Taper Pin

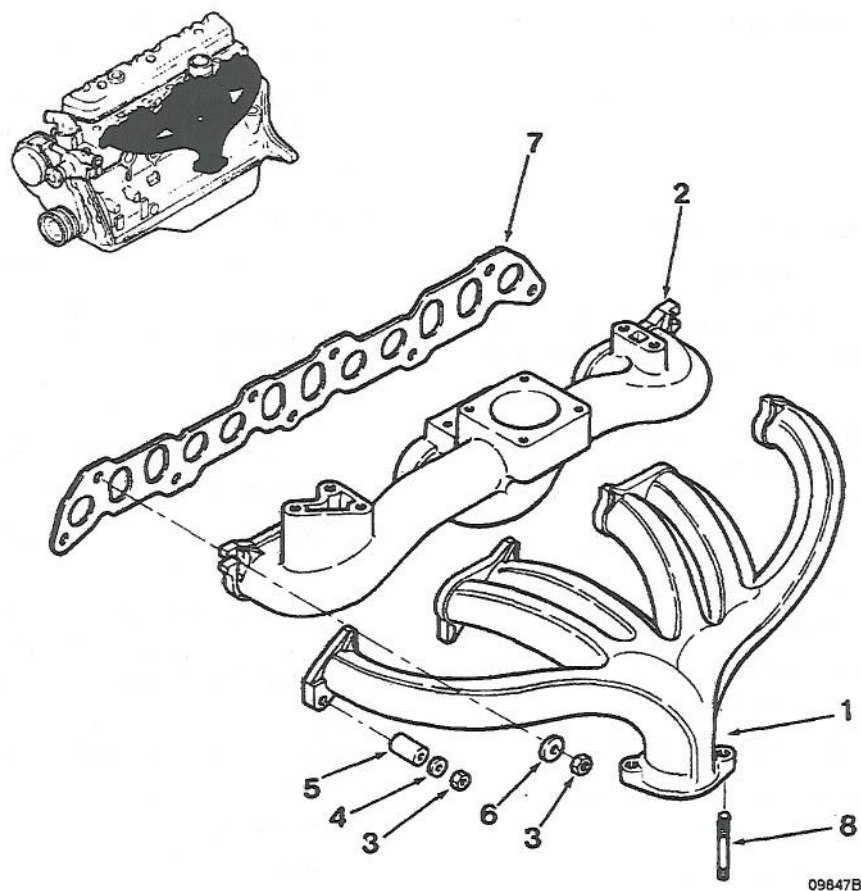
16. Shim
17. Venturi Valve
18. Screw
19. Shaft
20. Venturi Gasket
21. Venturi Housing
22. Accelerator Wire Bracket
23. Dashpot Assembly



09821B

Figure 5-4. Venturi and Dashpot Assembly Group

- (3) Remove screws with washers (2) from venturi assembly (1).
 - (4) Remove venturi assembly (1) from intake manifold.
 - (5) Remove venturi gasket (20).
 - (6) Remove accelerator wire bracket (22).
 - b. Disassembly. Disassemble venturi as follows:
 - (1) Remove split pin (12), spring (13), taper pin (15), valve stopper (14) and shim (16) from shaft (19).
 - (2) Remove hex nut (8), spring washer (9), control lever (10) and lever spring (11) from opposite end of shaft (19).
 - (3) Remove screws (18) and venturi valve (17).
 - (4) Clip lead seal wire and remove lever stop screw (3) and hex nut (4) from venturi housing (21).
 - (5) Remove opposite lever stop screw (3) and hex nut (4) from venturi housing (21).
 - (6) Slide shaft (19) out of venturi housing (21).
 - (7) Remove pipe joint screw (5), hose joint (7) and gaskets (6).
 - (8) Remove dashpot assembly (23).
 - c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures.
 - d. Repair and replacement. Replace all worn or damaged parts.
 - e. Assembly. Assemble venturi as follows:
 - (1) Install dashpot assembly (23).
 - (2) Install gaskets (6) and hose joint (7) on pipe joint screw (5).
 - (3) Thread pipe joint screw (5) into venturi housing (21). Tighten securely.
 - (4) Slide shaft (19) into venturi housing (21). Turn shaft (19) until venturi valve (17) seat is up.
 - (5) Install hex nut (4) and lever stop screw (3).
 - (6) Install hex nut (4) with lead seal onto opposite lever stop screw (3) with lead seal.
 - (7) Install venturi valve (17) and screws (18). Tighten securely.
 - (8) Install lever spring (11), control lever (10), spring washer (9) and hex nut (8) on shaft (19).
 - (9) Install shim (16), valve stopper (14), taper pin (15), spring (13) and split pin (12) on shaft (19).
 - (10) Adjust the venturi assembly (1) as required.
 - (11) Crimp lead seal on lever stop screw (3).
 - f. Installation. Install the venturi as follows:
 - (1) Install venturi gasket (20), accelerator wire bracket (22) and venturi housing (21) on intake manifold. Align holes.
 - (2) Install screws with washers (2) on venturi assembly (1) and tighten securely.
 - (3) Attach vacuum hose to hose joint (7).
 - (4) Attach accelerator linkage to accelerator wire bracket (22).
- 5-5.1.4. *Intake and Exhaust Manifolds Group.* Refer to figure 5-5, and perform the following steps to overhaul the intake and exhaust manifolds group.
- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the manifolds as follows:
 - (1) Refer to paragraph 5-5.1.3 and remove the venturi assembly.
 - (2) Remove hex nuts (3) and flat washers (6).
 - (3) Remove hex nuts (3), spring washer (4) and spacer (5).
 - (4) Remove studs (8).
 - (5) Remove intake manifold (2), exhaust manifold (1) and gasket (7).
 - b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures.
 - c. Repair and replacement. Replace all worn or damaged parts.
 - d. Reassembly and installation. Assembly is accomplished during installation. Install the manifolds as follows:
 - (1) Position gasket (7), intake manifold (2) and exhaust manifold (1) in place. Align all holes.
 - (2) Install studs (8).
 - (3) Install spacer (5), spring washer (4) and hex nuts (3).



- | | | |
|---------------------|------------------|-----------|
| 1. Exhaust Manifold | 4. Spring Washer | 7. Gasket |
| 2. Intake Manifold | 5. Spacer | 8. Stud |
| 3. Hex Nut | 6. Flatwasher | |

Figure 5-5. Intake and Exhaust Manifolds Group

(4) Install flat washers (6) and hex nuts (3).

(5) Refer to paragraph 5-5.1.3 and install venturi assembly.

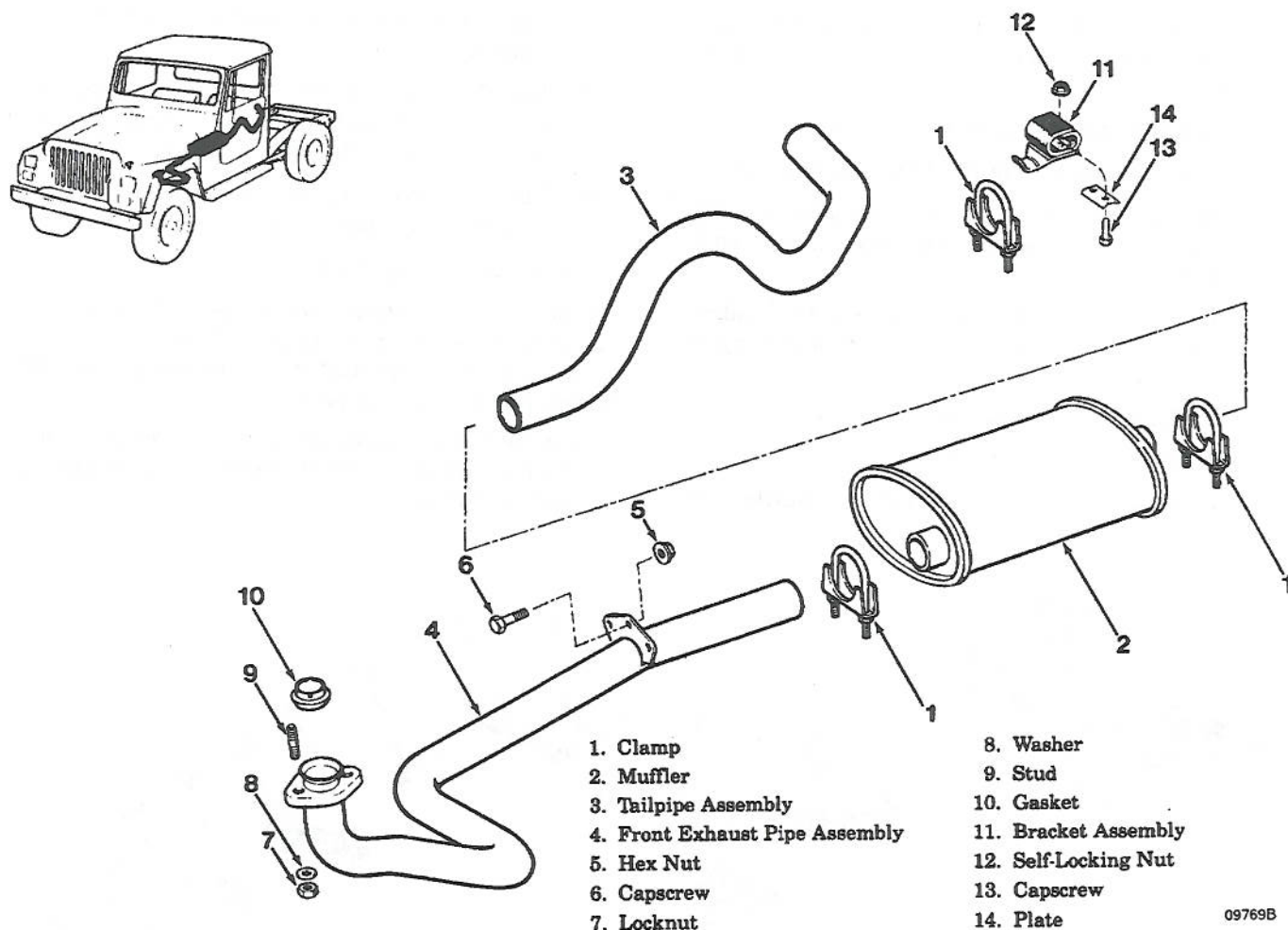
5-5.1.5 *Exhaust System*. Refer to figure 5-6, and perform the following steps to overhaul the exhaust system.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove exhaust system as follows:

WARNING

Do not work under raised vehicle without first supporting vehicle with safety jack stands.

- (1) Raise vehicle and support with jack stands.
- (2) Remove capscrew (13) and self-locking nut (12).
- (3) Remove reinforced plate (14) and tailpipe insulator and bracket assembly (11).
- (4) Disconnect rear exhaust clamp (1).



09769B

Figure 5-6. Exhaust System

WARNING

Welding and brazing operations produce heat, toxic fumes, radiation, metal slag and carbon particles. Welding and brazing goggles with the proper tinted lenses, gloves, apron or jacket, and welder's boots are required to protect the welder.

- (5) Heat tailpipe-to-muffler joint with oxyacetylene torch until cherry red.
- (6) Twist tailpipe assembly (3) back and forth to disengage.
- (7) Remove front exhaust clamp (1).
- (8) Place block of wood against front of muffler (2) and drive muffler (2) rearward to disengage.
- (9) Remove muffler (2).
- (10) Remove special locknuts (7) and washers (8).
- (11) Disconnect front exhaust pipe assembly (4) and remove gasket (10).
- (12) Remove flanged hex nut (5) and capscrew (6).
- (13) Remove front exhaust pipe assembly (4).
- (14) Remove mounting studs (9) from manifold.
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, clean front exhaust pipe mating surface on manifold.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install exhaust system as follows:

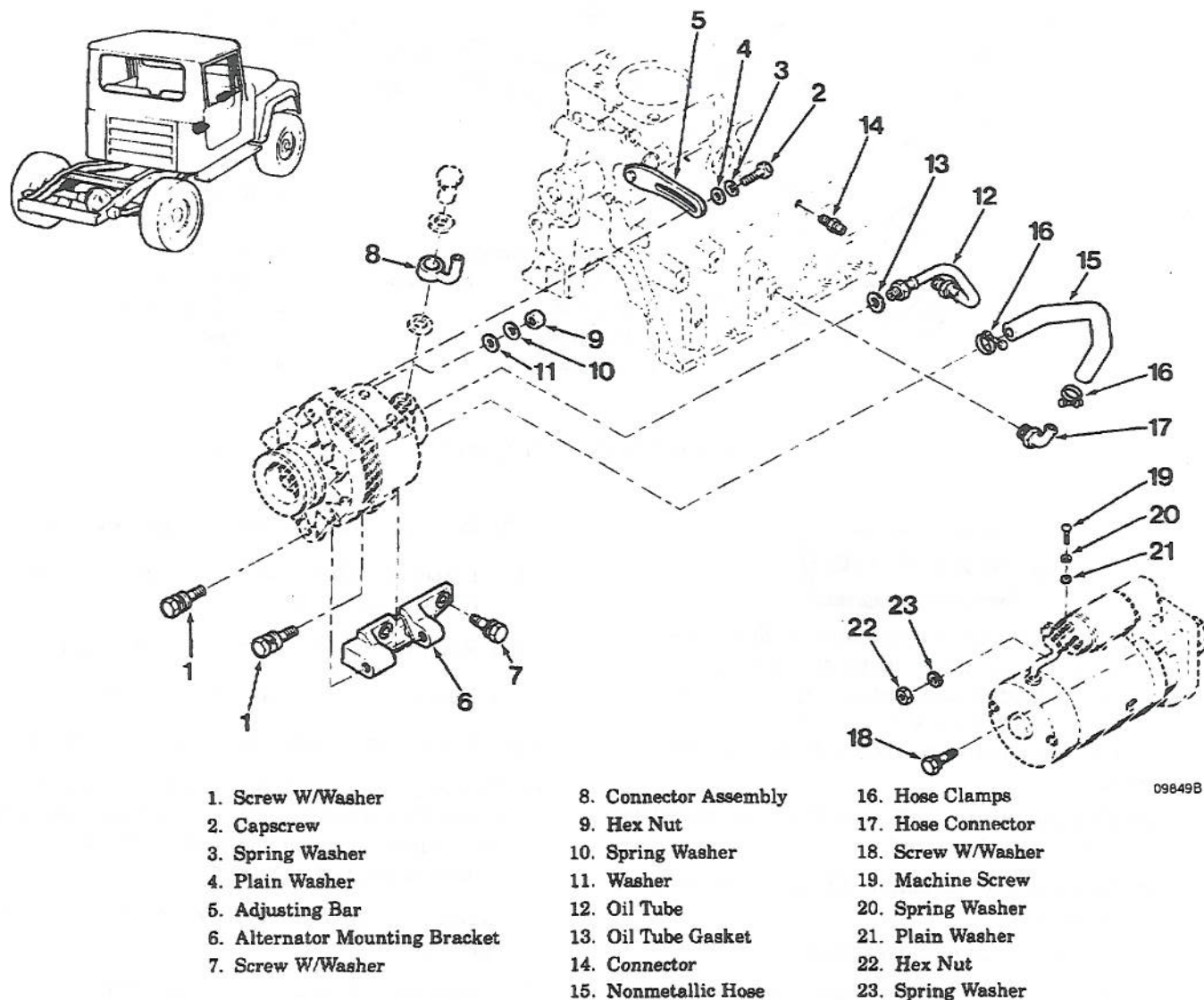
- (1) Position muffler (2) and connect front exhaust pipe (4) to it. Install clamp (1), but do not tighten.
- (2) Install mounting studs (9) in manifold.
- (3) Install gasket (10) in front exhaust pipe (4).
- (4) Install front exhaust pipe (4) on manifold using washers (8) and special locknuts (7), but do not tighten.
- (5) Align exhaust pipe (4) and connect to underside of vehicle using capscrew (6) and flanged hex nut (5).
- (6) Tighten clamp (1) at muffler.
- (7) Tighten special locknuts (7).
- (8) Connect tailpipe assembly (3) to muffler (2)

and install clamp (1) at muffler (2), but do not tighten.

- (9) Install tailpipe insulator and bracket assembly (11) and reinforcement plate (14) using cap-screw (13) and self-locking nut (12).
- (10) Install clamp (1) at tailpipe insulator and bracket assembly (11) and tighten.
- (11) Tighten clamp (1) at muffler (2).

5-5.1.6 *Alternator, Starter and Vacuum Pump Mounting Parts Group.* Refer to figure 5-7, and perform the following steps to overhaul the alternator, starter, and vacuum pump mounting parts.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the mounting parts as follows:



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Figure 5-7. Alternator, Starter and Vacuum Pump Mounting Parts Group

WARNING

Whenever disconnecting battery terminals, always disconnect negative GROUND terminal first. When reconnecting, reconnect GROUND terminal last.

- (1) Disconnect battery negative (GROUND) cable.
 - (2) Disconnect all electrical leads from starter motor assembly.
 - (3) Remove screws and washers (18) from starter motor assembly, and remove starter motor assembly from engine.
 - (4) Remove machine screw (19), spring washer (20) and plain washer (21).
 - (5) Remove hex nut (22) and spring washer (23) from bottom terminal of magnetic switch assembly.
 - (6) Refer to paragraph 5-5.1.7 for disassembly of starter motor assembly.
 - (7) Disconnect alternator electrical connector.
 - (8) Remove connector assembly (8).
 - (9) Remove screws and washers (7) and alternator mounting bracket (6).
 - (10) Remove screws and washers (1).
 - (11) Remove capscrew (2), spring washer (3) and plain washer (4) from adjusting bar (5).
 - (12) Remove alternator drive belt from alternator pulley.
 - (13) Remove oil tube (12) and oil tube gasket (13) from connector (14) and vacuum pump.
 - (14) Loosen hose clamps (16) and remove nonmetallic hose (15) from hose connector (17) and vacuum pump.
 - (15) Remove alternator assembly and vacuum pump from engine.
 - (16) Remove hex nut (9), spring washer (10) and washer (11).
 - (17) Remove bolts securing vacuum pump to alternator assembly and remove vacuum pump.
 - (18) Remove connector assembly (8) from vacuum pump.
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during removal. Install starter/ alternator/ vacuum pump mounting parts as follows:
- (1) Position magnetic switch assembly on starting motor and install hex nut (22) and spring washer (23) on bottom terminal of magnetic switch assembly.
 - (2) Install machine screw (19), spring washer (20) and plain washer (21).
 - (3) Install starting motor assembly on engine using screws and washers (18) tightened to torque specified in table 6-2.
 - (4) Connect all electrical leads to starting motor assembly.
 - (5) Install connector assembly (8) on vacuum pump.
 - (6) Install vacuum pump on alternator using bolts.
 - (7) Install washer (11), spring washer (10) and hex nut (9).
 - (8) Position alternator and vacuum pump on engine.
 - (9) Install nonmetallic hose (15) between hose connector (17) and vacuum pump and tighten hose clamps (16).
 - (10) Install oil tube gasket (13) and oil tube (12) between oil tube connector (14) and vacuum pump.

NOTE

All alternator mounting bolts should be finger tight at this stage of installation.

- (11) Install capscrew (2), spring washer (3) and plain washer (4) through adjusting bar (5) into alternator.
- (12) Install screws and washers (1).
- (13) Install screws and washers (7) into alternator mounting bracket (6).
- (14) Install alternator drive belt on pulley and tighten to tension specified in table 6-2.
- (15) Tighten capscrew (2) to tension specified in table 6-2.
- (16) Tighten screws and washers (7) and (1) to tension specified in table 6-2.
- (17) Connect alternator electrical connector.

WARNING

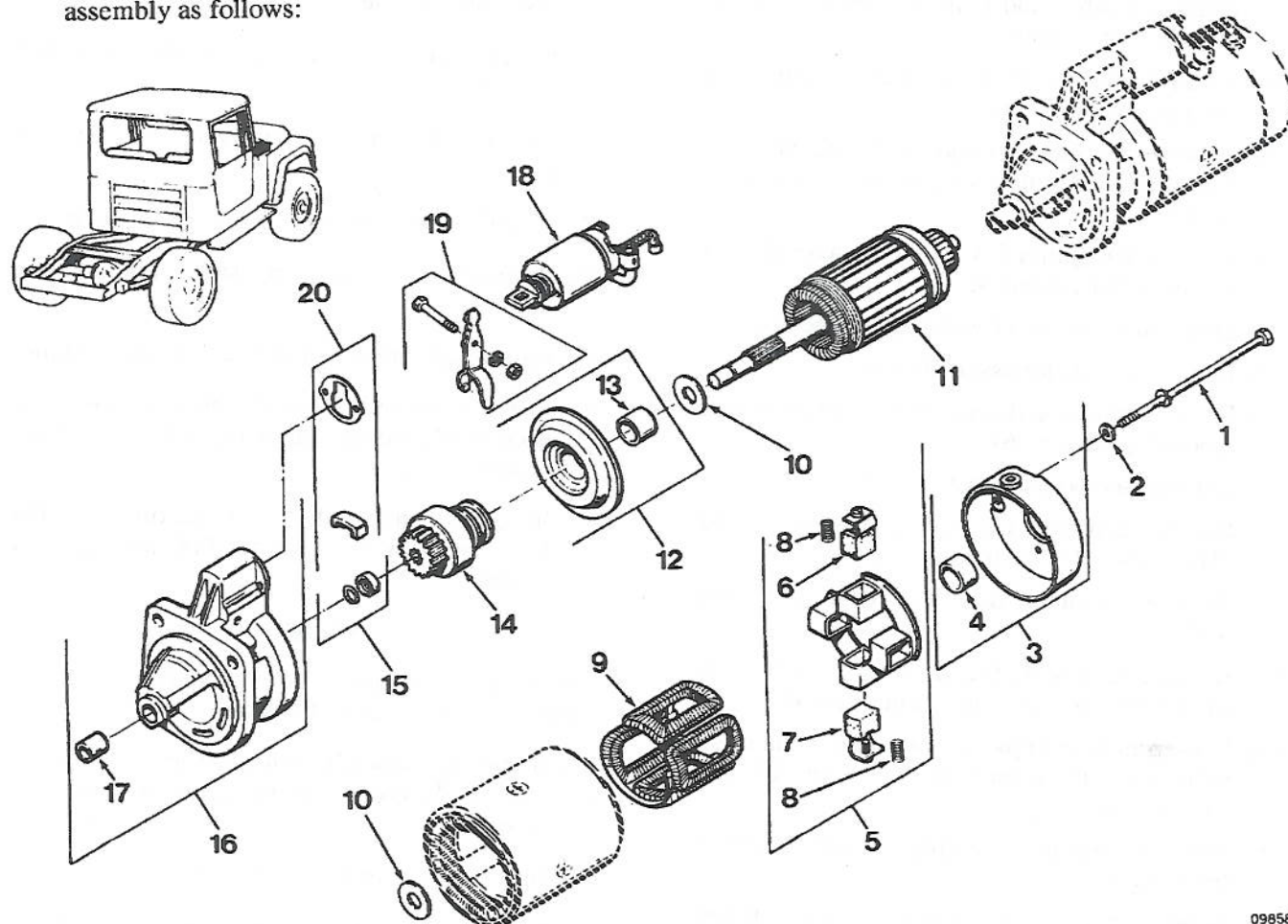
When reconnecting battery terminals, always connect negative (GROUND) terminal last.

(18) Connect battery negative (GROUND) cable.

5-5.1.7 *Starting Motor Assembly*. Refer to figure 5-8, and perform the following steps to overhaul the starting motor assembly.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove starting motor assembly as follows:

- (1) Remove nut from bottom terminal of magnetic switch assembly (18), and detach wire from terminal.
- (2) Remove bolts attaching magnetic switch assembly (18) to dust cover (20), and remove magnetic switch assembly (18) from starting motor assembly.
- (3) Remove thrust bolts (1) and washers (2) from rear cover assembly (3). Remove rear cover assembly (3).



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- | | | |
|--------------------------|-----------------------------|------------------------------|
| 1. Thrust Bolt W/Washer | 8. Brush Spring | 15. Pinion Stopper |
| 2. Washer | 9. Field Coil Assembly | 16. Gear Case Assembly |
| 3. Rear Cover Assembly | 10. Thrust Washer Kit | 17. Bushing |
| 4. Rear Cover Bushing | 11. Armature Assembly | 18. Magnetic Switch Assembly |
| 5. Brush Holder Assembly | 12. Center Bearing Assembly | 19. Shift Lever |
| 6. Brush | 13. Bearing | 20. Dust Cover |
| 7. Brush | 14. Pinion Assembly | |

Figure 5-8. Starting Motor Assembly

CAUTION

Do not lift brushes by their pigtails while the brush spring is exerting pressure on the brush.

NOTE

For the following step, use short length of wire or other suitable implement.

- (4) Lift brushes (6) and (7) out of brush holder assembly (5) in field coil assembly (9).
 - (5) Slide brush holder assembly (5) and thrust washers (10) off shaft of armature assembly (11), and remove brushes (6) and (7) and brush springs (8).
 - (6) Remove rear cover bushing (4) from shaft of armature assembly.
 - (7) Remove pin of shift lever (19) from gear case assembly (16).
 - (8) Slide field coil assembly (9) off armature assembly (11).
 - (9) Remove bushing (17) and separate gear case assembly (16) from armature assembly (11).
 - (10) Remove shift lever (19) from gear case assembly (16).
 - (11) Remove dust cover (20) from gear case assembly (16).
 - (12) Pry pinion stopper (15) from shaft of armature assembly (11).
 - (13) Slide pinion assembly (14) off shaft of armature assembly (11).
 - (14) Slide center bearing assembly (12) (including bearing (13)) off shaft of armature assembly (11).
 - (15) Slide thrust washers (10) off shaft of armature assembly (11).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi and wearing of goggles is required.

- (1) Use brush or air to clean field coil assembly (9), armature assembly (11), gear case assembly (16), magnetic switch assembly (18) and clutch portion of pinion assembly (14).

WARNING

P-D-680 Type 11 is toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Good general ventilation is normally adequate.

CAUTION

Do not wash pinion clutch or drive assembly. If these components are washed, damage may result.

- (2) Wash all parts, except pinion clutch and drive assembly, in P-D-680 Type II and dry.
- (3) Inspect armature windings for broken or burned insulation and poor connections.
- (4) Inspect armature windings for open and short circuits as outlined in paragraph 5-5.1.17c, Testing.

CAUTION

Do not use emery cloth to clean commutator. If emery cloth is used, damage to commutator could result.

- (5) Clean dirty commutator with commutator paper.
- (6) Check to see if commutator is worn, out of round, or has insulation protruding between contacts. If so, commutator must be replaced.
- (7) Inspect shaft of armature (11) and bushings (4) and (17) for scoring and wear.
- (8) Inspect drive assembly pinion clutch for damage. An engine that has repeated starting motor pinion clutch failures should be inspected for:
 - (a) Correct ring gear clearance in relation to starting motor mounting surface.

CAUTION

Inspect the entire circumference of the flywheel gear for damage when teeth of the drive assembly pinion gear are damaged. (Normal wear pattern extends approximately 2 inches along the circumference of the flywheel gear.)

- (b) Missing or wrong parts and loose or misaligned flywheel.
- (9) Inspect drive assembly pinion clutch by grasping and rotating pinion gear. Gear should rotate freely in one direction and lock in opposite direction.

- (10) Inspect brush springs (8) for wear and damage.
- (11) Inspect field windings for burned or broken insulation and for broken or loose connections. Examine field brush connections and wire insulation.

c. Testing. Refer to the figures in this section and perform the following test procedures:

(1) Armature coil short circuit test. See figure 5-9.

- (a) Mount armature in growler and turn switch to GROWLER.
- (b) Hold steel blade parallel to, and in contact with, armature.
- (c) Slowly rotate armature. If steel blade vibrates at any time, armature is shorted and must be replaced.

(2) Armature coil open circuit test. See figure 5-10.

- (a) Mount armature in growler and turn switch to TEST with voltage at highest setting.
- (b) Place probes of test leads across adjacent commutator segments.
- (c) Test each adjacent pair of commutator segments. A zero reading at any point indicates an open circuit. Commutator must be replaced.

(3) Armature coil insulation test. See figure 5-11.

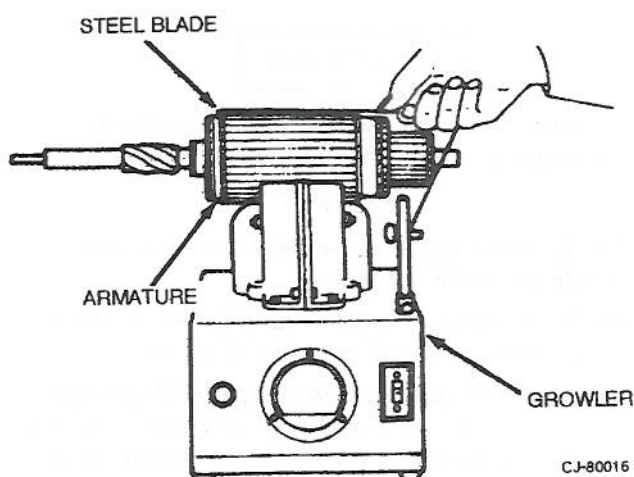
- (a) Place one ohmmeter lead on commutator segment.
- (b) Place second ohmmeter lead on armature shaft. Continuity indicates faulty insulation. Armature must be replaced.

(4) Armature shaft-to-bushing clearance check. See figure 5-12.

- (a) Measure armature shaft diameters at points A, B, C, D.
- (b) Measure bushings at all points.
- (c) Compare measurements with wear limits. If wear limits exceed specifications given in table 6-1, bushings must be replaced.

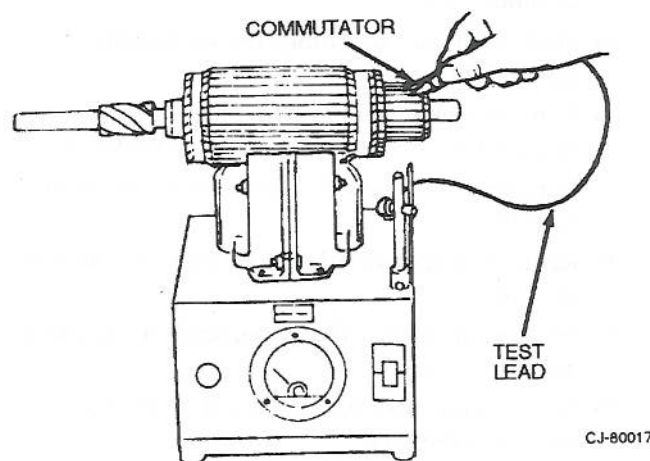
(5) Armature shaft alignment check. See figure 5-13.

- (a) Support both ends of armature shaft in lathe or similar centering tool.



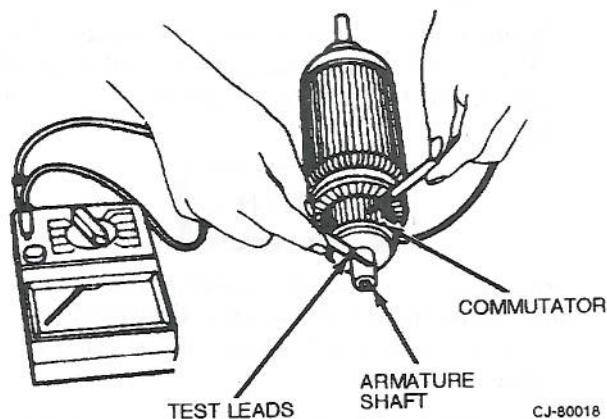
CJ-80016

Figure 5-9. Coil Short Circuit Test



CJ-80017

Figure 5-10. Coil Open Circuit Test



CJ-80018

Figure 5-11. Coil Insulation Test

- (b) Place dial indicator against sliding part of center bearing.

NOTE

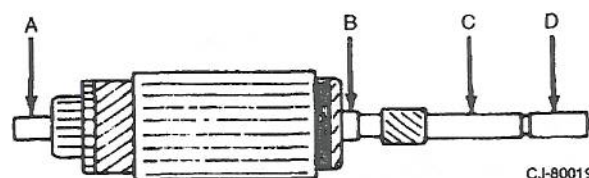
Actual deflection is one-half of indicator reading.

- (c) Check dial indicator while rotating armature. If deflection exceeds the measurement prescribed in table 6-1, shaft is out of alignment and must be replaced.
- (6) Commutator wear test. See figure 5-14.

NOTE

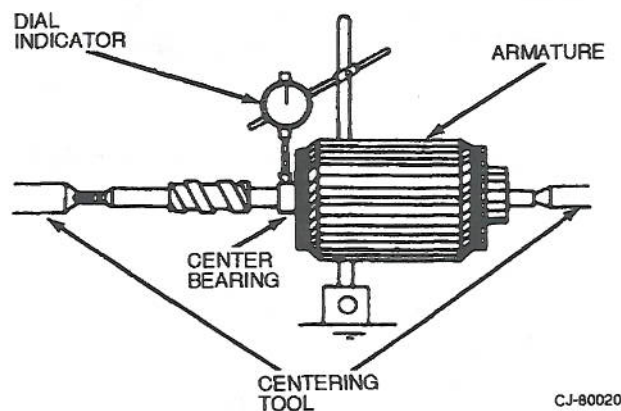
If commutator segments are rough, polish them with commutator paper before testing.

- (a) Mount dial indicator to measure eccentricity and taper of sliding surface of commutator.
- (b) Rotate armature and note indicator reading. If deflection exceeds the figure prescribed in table 6-1, commutator is excessively worn and must be replaced.
- (7) Commutator insulation test. See figure 5-15.
- (a) Measure depth of insulating material between each commutator segment. If depth is less than the figure prescribed by table 6-1, commutator is excessively worn and must be replaced. If depth is greater than figure prescribed by table 6-1, commutator must be repaired.
- (8) Field coil-to-coil continuity test. See figure 5-16.
- (a) Connect leads of ohmmeter to field coil brush terminals.
- (b) Continuity indicates either open or broken field coil. Interconnecting wire and field coil must be replaced.
- (9) Field coil-to-frame continuity test. See figure 5-17.
- (a) Connect leads of ohmmeter between field coil frame and either brush terminal.
- (b) Continuity indicates open field coil circuit. Field coil must be replaced.
- (10) Brush holder insulation test. See figure 5-18.
- (a) Connect one lead of ohmmeter to insulation of brush holder and other lead to ground end of brush holder.



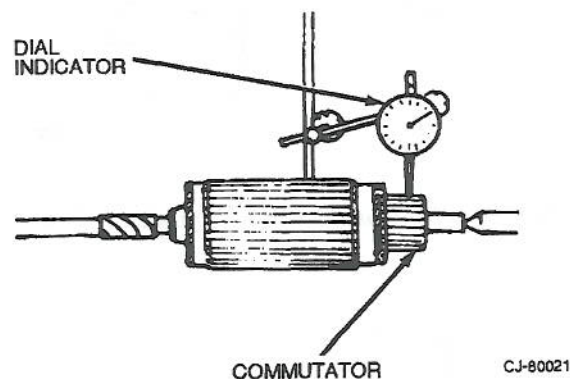
CJ-80019

Figure 5-12. Shaft-to-Bushing Clearance Check



CJ-80020

Figure 5-13. Armature Shaft Alignment Check



CJ-80021

Figure 5-14. Commutator Wear Test

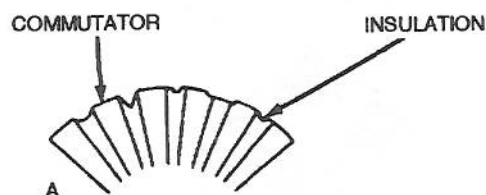


Figure 5-15. Commutator Insulation Test

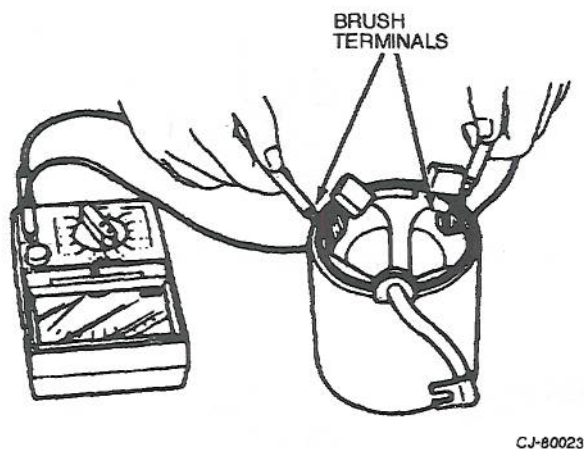


Figure 5-16. Field Coil-to-Coil Continuity Test

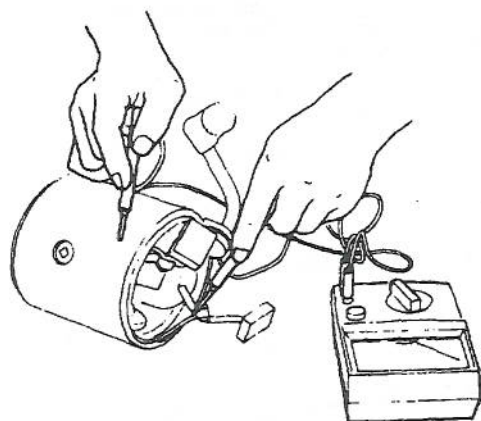


Figure 5-17. Coil-to-Frame Continuity Test

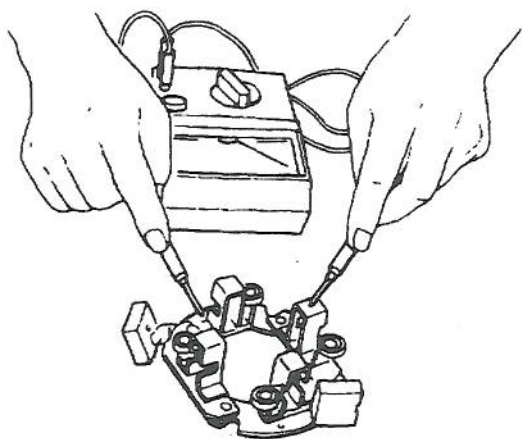
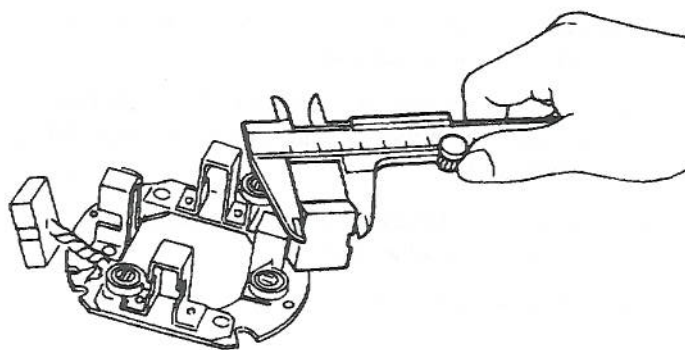


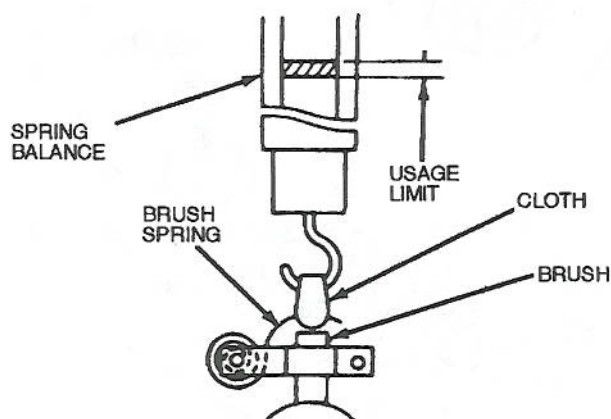
Figure 5-18. Brush Holder Insulation Test

- (b) Continuity indicates faulty insulation. Brush holder must be replaced.
- (11) Brush wear test. See figure 5-19.
 - (a) Measure brush length.
 - (b) If length is less than the figure prescribed in table 6-1, brush must be replaced.
- (12) Brush spring tension test. See figure 5-20.
 - (a) Set up spring balance gauge.
 - (b) If tension is not within limits prescribed by table 6-1, brush must be replaced.
- (13) Magnetic switch assembly shunt coil continuity test. See figure 5-21.
 - (a) Connect ohmmeter leads between magnetic switch assembly (18) and top terminal of magnetic switch assembly (18).
 - (b) Zero continuity indicates open shunt coil. Magnetic switch assembly (18) must be replaced.
- (14) Magnetic switch assembly series coil continuity test.
 - (a) Connect ohmmeter leads between top and bottom terminals of the magnetic switch assembly (18).
 - (b) Zero continuity indicates open series coil. Magnetic switch assembly (18) must be replaced.
- d. Repair and replacement. Replace all worn or damaged parts except as follows:
 - (1) If depth of commutator insulation is greater than the figure specified in table 6-1, remove insulation to depth specified in REPLACEMENT column of table 6-1.
 - (2) Bevel edges of commutator segments with commutator paper as shown in figure 5-22.
- e. Assembly. Assemble starting motor assembly as follows:
 - (1) Slide thrust washers (10) on shaft of armature assembly (11).
 - (2) Slide center bearing assembly (12), including bearing (13), on shaft of armature assembly (11).
 - (3) Slide pinion assembly (14) on shaft of armature assembly (11).
 - (4) Press pinion stopper (15) and pinion stopper ring on shaft of armature assembly (11).
 - (5) Insert dust cover (20) in gear case (16).
 - (6) Insert shift lever (19) in gear case (16).



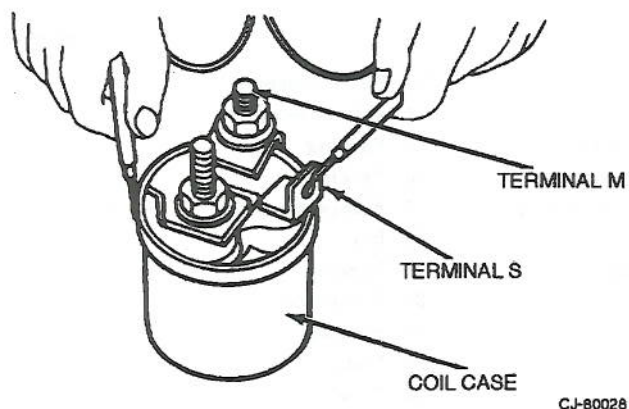
CJ-80026

Figure 5-19. Brush Wear Test



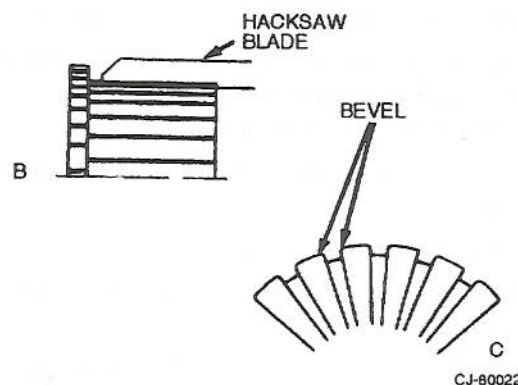
CJ-80027

Figure 5-20. Brush Spring Tension Test



CJ-80028

Figure 5-21. Shunt Coil Continuity Test



CJ-80022

Figure 5-22. Commutator Insulation Repair

- (7) Place armature assembly (11) in gear case (16) and install bushing (17).
- (8) Slide frame and field coil assembly (9) on armature assembly (11).
- (9) Thread pin of shift lever (19) in gear case (16) and tighten.
- (10) Slide thrust washers (10) and brush holder assembly (5) on shaft of armature assembly (11).
- (11) Insert brushes (6) and (7) and brush springs (8) in brush holders (5).
- (12) Place rear cover bushing (4) and rear cover (3) on starting motor assembly. Thread through bolts (1) with washers (2) in starter motor assembly. Thread screws into rear cover (3) and tighten.
- (13) Place magnetic switch assembly (18) on dust cover (20) and tighten bolts.
- (14) Place wire on bottom terminal of magnetic switch assembly and tighten nut.
- (15) Check the operation of the starting motor and, if necessary, adjust it as follows:
 - (a) Connect 12 vdc power source between top and bottom terminals of magnetic switch assembly (18).
 - (b) Measure distance between pinion (14) and pinion stopper (15).

NOTE

The two available dust covers act as adjusting plates. One is 0.057 inch thick. The other is 0.0314 inch thick.

- (c) If gap is not between figures specified by table 6-1, install alternate dust cover.

f. Installation. Install starting motor assembly.

5-5.1.8 *Alternator and Vacuum Pump Group*. Refer to figure 5-23, and perform the following steps to overhaul the alternator and vacuum pump group.

a. Removal. Remove the alternator and vacuum pump group as follows:

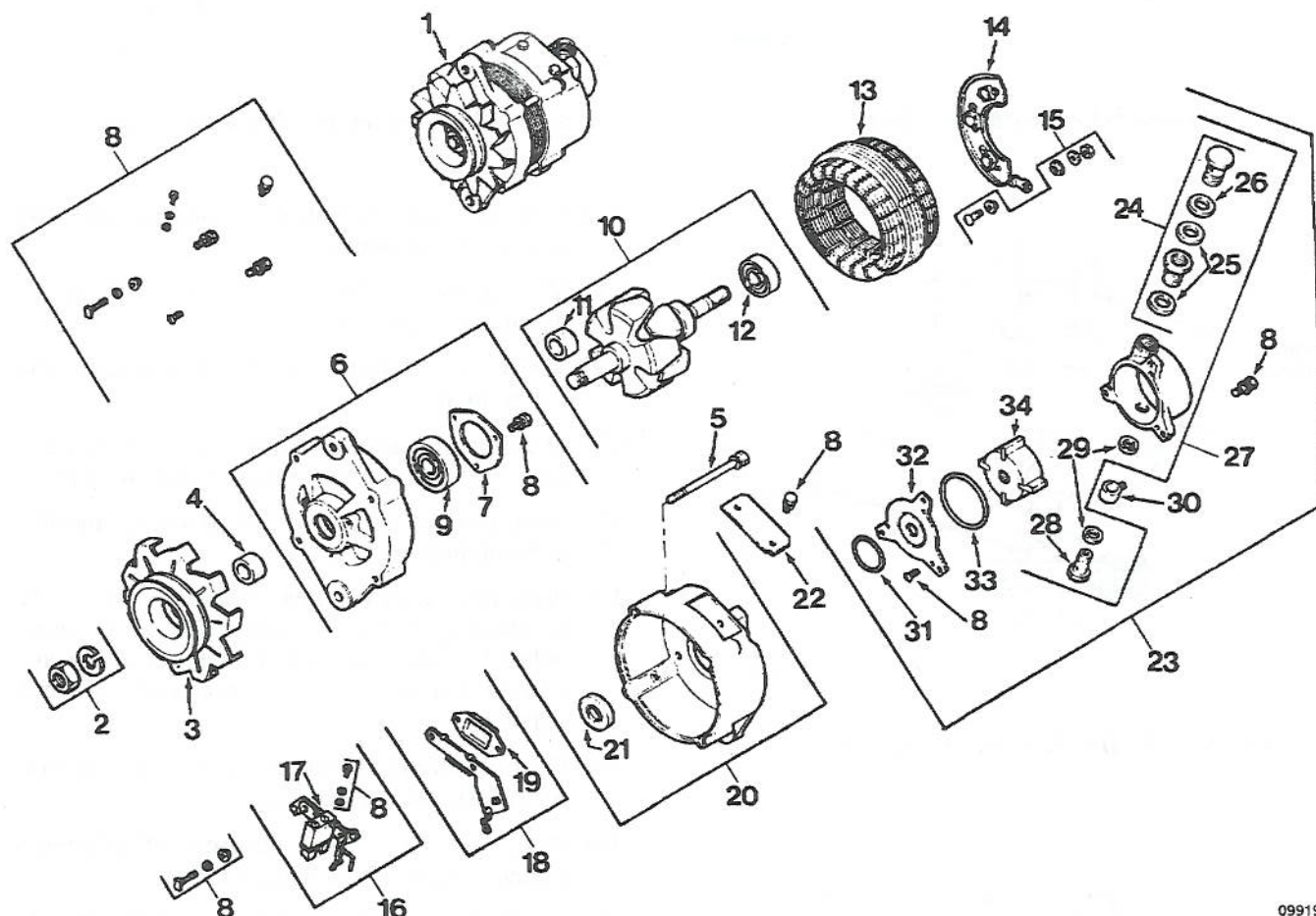
- (1) Disconnect battery negative cable.
- (2) Disconnect alternator electrical connector.

(3) Refer to paragraph 5-5.1.6 and remove all alternator mounting parts.

(4) Remove alternator drive belt from alternator pulley assembly (3), and remove alternator assembly (1).

b. Disassembly. Disassemble the alternator and vacuum pump group as follows:

- (1) Remove bolts (5).



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- | | | |
|----------------------------|--------------------------|---------------------|
| 1. Alternator Assembly | 12. Bearing | 23. Pump Assembly |
| 2. Nut And Washer Assembly | 13. Stator Assembly | 24. Valve Assembly |
| 3. Pulley Assembly | 14. Diode Assembly | 25. Packing |
| 4. Spacer | 15. Bolt Assembly | 26. Packing |
| 5. Bolts | 16. Brushholder Assembly | 27. Flange Assembly |
| 6. Front Cover Assembly | 17. Brush | 28. Bolt |
| 7. Bearing Retainer | 18. Terminal Assembly | 29. Packing |
| 8. Screw Kit | 19. Block | 30. Connector |
| 9. Bearing | 20. Rear Cover | 31. Packing |
| 10. Rotor Assembly | 21. Oil Seal | 32. Plate |
| 11. Spacer | 22. Cover | 33. Packing |
| | | 34. Rotor |

Figure 5-23. Alternator and Vacuum Pump Group

- (2) Remove screws from screw kit (8) and cover (22).
- (3) Remove screws from screw kit (8), and remove brushes (17) from brushholder assembly (16).

CAUTION

Separate front and rear covers carefully to avoid damage to rear cover oil seal.

- (4) Separate front cover assembly (6) and rear cover assembly (20).
- (5) Clamp front end of rotor assembly (10) in vise with soft jaws and remove nut and washer assembly (2), pulley assembly (3) and spacer (4).
- (6) Remove oil seal (21) from rear cover (20).
- (7) Remove screw kit (8) screws, bearing retainer (7) and bearing (9).
- (8) Separate front cover assembly (6) and rotor assembly (10) by tapping front cover with suitable mallet.
- (9) Remove spacer (11) and bearing (12).
- (10) Remove bolt assembly (15), stator assembly (13) and diode assembly (14).
- (11) Remove brushholder portion of brushholder assembly (16).

WARNING

Avoid breathing fumes generated by soldering or unsoldering as injury to personnel may result.

CAUTION

When disconnecting stator assembly from diode assembly, use soldering gun with a high heating capacity to melt solder quickly, and use suitable pliers to group leads immediately below soldering iron or heat may damage diode assembly.

NOTE

Tag and mark all wires before disconnecting.

- (12) Melt solder at leads and disconnect stator assembly (13) and diode assembly (14).
- (13) Melt solder at terminal assembly (18) and lead wire connection and separate brushholder assembly (16), terminal assembly (18) and diode assembly (14).
- (14) Melt solder as required and remove block (19) from terminal assembly (18).

- (15) Remove screw kit (8) screws and pump assembly (23).
 - (16) Separate plate (32) from flange assembly (27) and remove packings (31) and (33).
 - (17) Remove rotor (34) from flange assembly (27).
 - (18) Remove bolt (28), two packings (29) and connector (30).
 - (19) Remove valve assembly (24) and packings (25) and (26).
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi and wearing of goggles is required.

- (1) Clean all vacuum pump assembly parts in solvent and dry them using filtered compressed air.
- (2) Inspect rotor surfaces and flange assembly bore for pitting, wear, cracks or scoring, and check all rotor vanes for free movement in rotor slots. Vanes must not stick or bind. Any part exhibiting these conditions is defective.
- (3) Measure length and height of rotor vanes for vanes that are worn beyond limits specified in table 6-1. Vanes worn beyond limits are defective.

CAUTION

Do not clean rotor with degreasing solvent or damage to rotor may result.

- (4) Clean rotor poles by brushing with Isopropyl alcohol (17, table 5-1) or equivalent.

WARNING

Isopropyl alcohol is flammable and toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Keep away from open flame or any other ignition source.

CAUTION

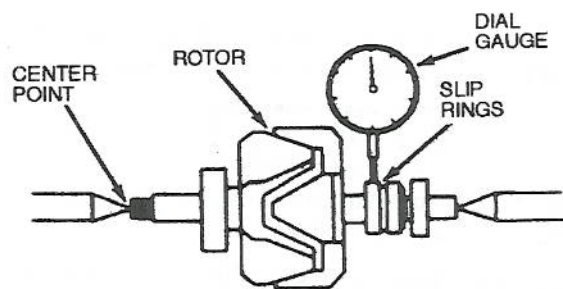
When using abrasive, support the rotor while spinning to clean slip rings evenly. Cleaning slip rings without support may result in flat spots on slip rings which may cause brush noise and premature brush wear.

- (5) Inspect slip rings for dirt, roughness or pitting, and clean with solvent. If necessary, clean and finish slip rings with commutator paper or equally abrasive polishing cloth.
- (6) Clean stator assembly (13) by brushing with Isopropyl alcohol or equivalent.
- (7) Inspect brush springs for damage or corrosion.
- (8) Inspect brushes for wear or contamination. Brushes must not be worn past limit specified in table 6-1. Also check for uneven wear of loose pigtails. If brushes are to be used again, clean with soft dry cloth until completely free of lubricant.
- (9) Measure slip ring out-of-round with dial gauge as shown in figure 5-24 to make sure slip rings are within limits specified by table 6-1.
- (10) Measure slip ring diameter, as shown in figure 5-25, to make sure wear does not exceed limit specified in table 6-1.
- (11) Inspect bearings (21) and (9) for wear or damage.
- (12) Check for continuity of three stator terminals.
- (13) Check continuity, as shown in figure 5-26, between three terminals and core. If continuity exists, coil is grounded and must be replaced.
- (14) Refer to table 5-2 and figures 5-27 and 5-28 to check continuity of diodes in reverse direction of diodes. If there is continuity in one direction (correct forward direction), diode is all right. If there is continuity in both directions, or if there is no continuity in either direction, diode is defective.

Table 5-2. Diode Continuity Chart

Result	Ohmmeter Probes		Acceptable Result
	(+)	(-)	
N-P Diode(-)	Diode Holder	Holder Diode	Continuity
	Diode	Holder (rear cover)	No Continuity
P-N Diode(+)	Holder (rear cover)	Diode	Continuity
	Diode	Holder	No Continuity

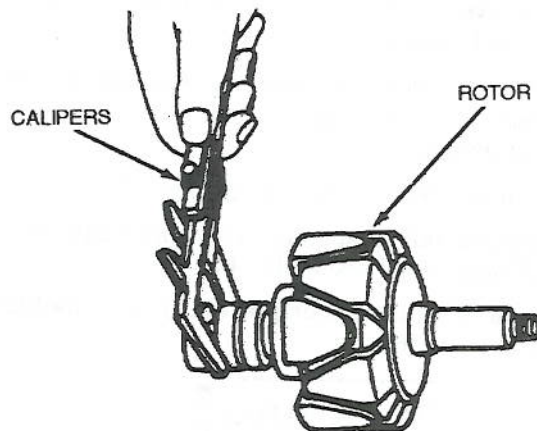
Repair limit 0.012 in. (0.3 mm)



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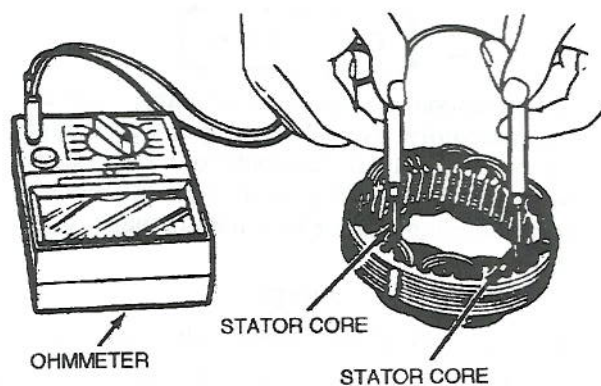
Figure 5-24. Slip Ring Out-of-Round Measurement

O.D. wear limit 1.20 in. (30.6 mm)



CJ-70016

Figure 5-25. Slip Ring Wear Measurement



CJ-70021

Figure 5-26. Stator Coil Continuity Test

(15) Refer to figure 5-29, and test the regulator assembly as follows:

- (a) Connect regulator assembly as shown in figure 5-29, using a variable resistor, two 12-volt batteries, a resistor and a voltmeter.
 - (b) Check V1 (voltage of battery 1). If voltage reading is between 10 volts and 13 volts, BAT 1 is satisfactory.
 - (c) Check V3 (voltage of BAT 1 + BAT 2). If voltage reading is between 20 volts and 26 volts, both BAT 1 and BAT 2 are satisfactory.
 - (d) Measure V2 (voltage between terminals F and E) by slowly moving variable resistor from 300 ohms. Check if any voltage of V2 becomes equivalent to V1 of BAT 1 measured in step (b). If there is no point where the voltage changes, the regulator is defective.
 - (e) Measure V4 (voltage between the middle tap of variable resistor and terminal E). With the variable resistor (RV) held in a fixed position, measure V4. Voltmeter should show 14 volts. If voltage shown is correct, the regulator is satisfactory. If voltage shown is incorrect, the regulator is defective and must be replaced.
- d. Repair and replacement. Replace all worn or damaged parts. In addition, perform the following steps:
- (1) Replace pump assembly (23) parts found to be defective.

CAUTION

When using an abrasive, support rotor while spinning to clean slip rings evenly. Cleaning slip rings without support may result in flat spots on slip rings, which may result in brush noise and premature brush wear.

- (2) Repair rough or out-of-round slip rings in lathe to obtain maximum out-of-round limit as specified in table 6-1. Remove only enough material to make rings smooth and round. Finish with commutator paper or 400 grit polishing cloth, and blow away all dust. If slip ring wear exceeds limit specified in table 6-1, replace rotor assembly (10).
- (3) Replace brushes (17) if they are worn beyond limits specified in table 6-1, if they show uneven wear or loose pigtails, or if brush

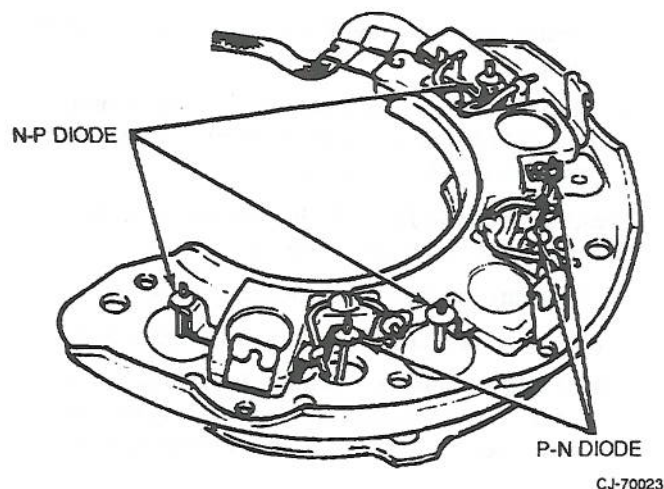


Figure 5-27. Diode Locations

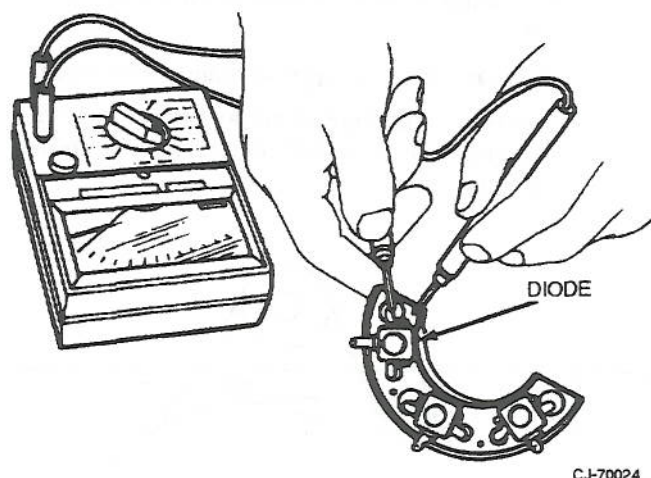
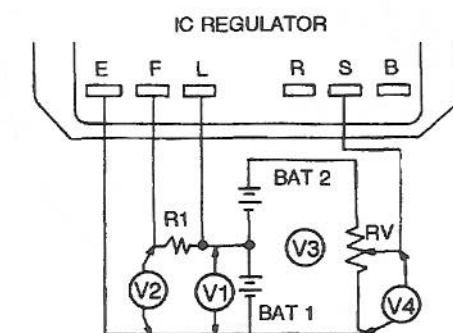


Figure 5-28. Current Flow of Diode Test



RESISTOR (R1)
VARIABLE RESISTOR (RV)
BATTERY (BAT 1, BAT 2)
DC VOLTMETER
(4-POINT MEASUREMENT)

10 OHMS 3W
0-300 3W
12V 2 PCS
0-30V
0.5 CLASS

Figure 5-29. IC Regulator Test Circuit Diagram

springs show any evidence of damage or corrosion.

- (4) Replace stator assembly (13) or diode assembly (14) if stator, diode or regulator assembly are found to be defective.

e. Testing. Refer to figure 5-30, and perform the following tests on an assembled alternator:

- (1) Measure voltage regulation as follows:

- (a) Set up test circuit as shown in figure 5-30.
- (b) Hold switch 2 open and close switch 1. Rotate alternator, gradually increasing the speed. As speed is increased, lamp should go out.

NOTE

Voltage should be measured between terminals "S" and "E".

- (c) Increase speed to approximately 5000 rpm.
- (d) Measure amperage. If amperage is more than 5 amps, connect a 0.25 ohm resistor as shown in figure 5-30.

- (e) Voltmeter reading must be at regulating voltage and within specified value.

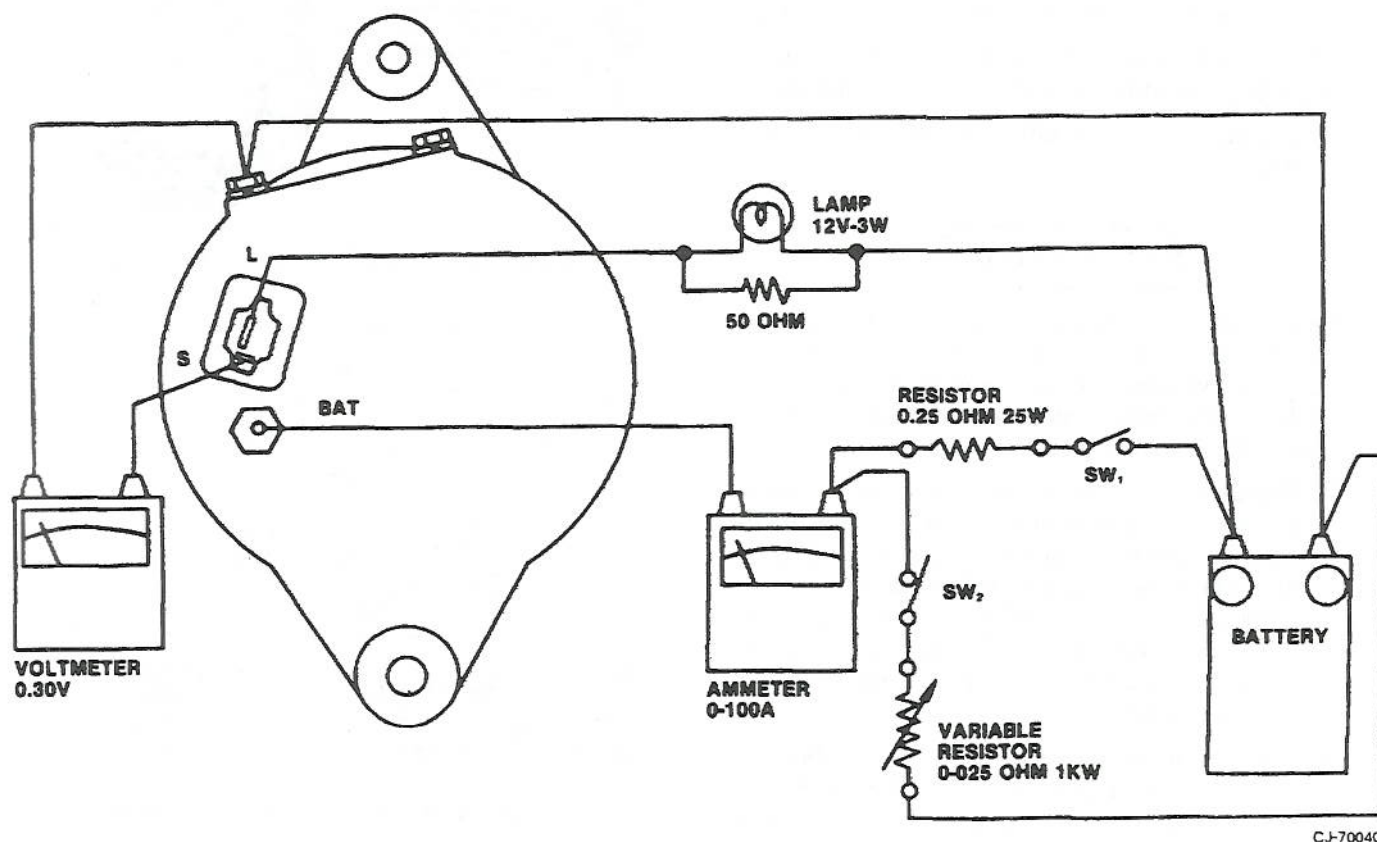
- (f) Increase speed further and observe whether the regulating voltage varies with the changes in speed or not.

- (2) Measure voltage at running speed, as follows:

- (a) Hold switch 1 and switch 2 open. Rotate alternator at 2000 rpm.
- (b) Observe voltmeter reading and gradually lower alternator speed to obtain 14 volts on terminal "B" of alternator.
- (c) If alternator running speed is 1050 rpm or less at 14 volts, the cut-in speed is satisfactory.

- (3) Measure output current as follows:

- (a) Adjust variable resistor to maximum resistance and close switch 1 and switch 2.
- (b) Rotate alternator and maintain 14 volts by regulating variable resistor.



CJ-70040

Figure 5-30. Alternator Voltage Regulation Test Circuit Diagram

- (c) Increase alternator speed to 5000 rpm and note ammeter reading.
- (d) If ammeter reading is higher than specified 50 amps, the output current is satisfactory.
- f. Assembly. Assemble the alternator and vacuum pump group as follows:

WARNING

Avoid breathing the fumes generated by soldering or unsoldering as injury to personnel may result.

- (1) Install regulator assembly portion of diode assembly (14), as marked during disassembly, to terminal block (19) using rosincore solder (18, table 5-1).
- (2) Install holder assembly (16) to diode assembly (14) using screws from screw kit (8). Connect terminal block (19) and lead wire, as marked during disassembly, using rosin-core solder (item 18, table 5-1).
- (3) Lubricate bearing (12) with lubricant (19, table 5-1) and press bearing (12) onto shaft of rotor assembly (10).
- (4) Carefully press oil seal (21) into place in rear cover (20).
- (5) Using screws from screw kit (8), install brush-holder assembly (16) and terminal assembly (18) in rear cover assembly (6).
- (6) Install diode assembly (14) using bolt assembly (15).
- (7) Install stator assembly (13).
- (8) Fill cavity between bearing (9) and retainer (7) with lubricant (19, table 5-1) and press bearing (9) into front cover (6).
- (9) Install retainer (7) with screws from screw kit (8).
- (10) Install spacer (11). Then install rotor assembly (10) in front core assembly (6).
- (11) Secure rotor carefully in a vise with soft jaws and install spacer (4) and pulley assembly (3) with nut and washer assembly (2). Tighten nut to torque specified in table 6-2.
- (12) Align and install rear cover (20) to front cover assembly (6) and secure with four bolts (5).
- (13) Install brushes (17) and secure with screws from screw kit (8).
- (14) Install cover (22) with screws from screw kit (8).
- (15) Apply a light coat of oil to all vacuum pump assembly (23) parts.
- (16) Support alternator assembly (1) vertically and position packing (31) on plate (32).
- (17) Install plate (32) and position packing (33) on plate (32).
- (18) Position rotor (34) on shaft of alternator assembly (1) so that flat end of rotor (34) is away from alternator assembly (1).
- (19) Install valve assembly (24) with packings (25) and (26) assembled.
- (20) Install connector bolts (28) and connector (30) with packings (29).
- (21) Install housing portion of flange assembly (27), align mounting holes with holes for rear cover (20) and plate (32), and secure with screws from screw kit (8).
- g. Installation. Install alternator and vacuum pump as follows:
 - (1) Refer to figure 5-23, and install alternator assembly (1) and alternator pulley assembly.
 - (2) Refer to paragraph 5-5.1.6 and install all alternator mounting parts.
 - (3) Connect alternator electrical connector.
 - (4) Connect battery negative cable.

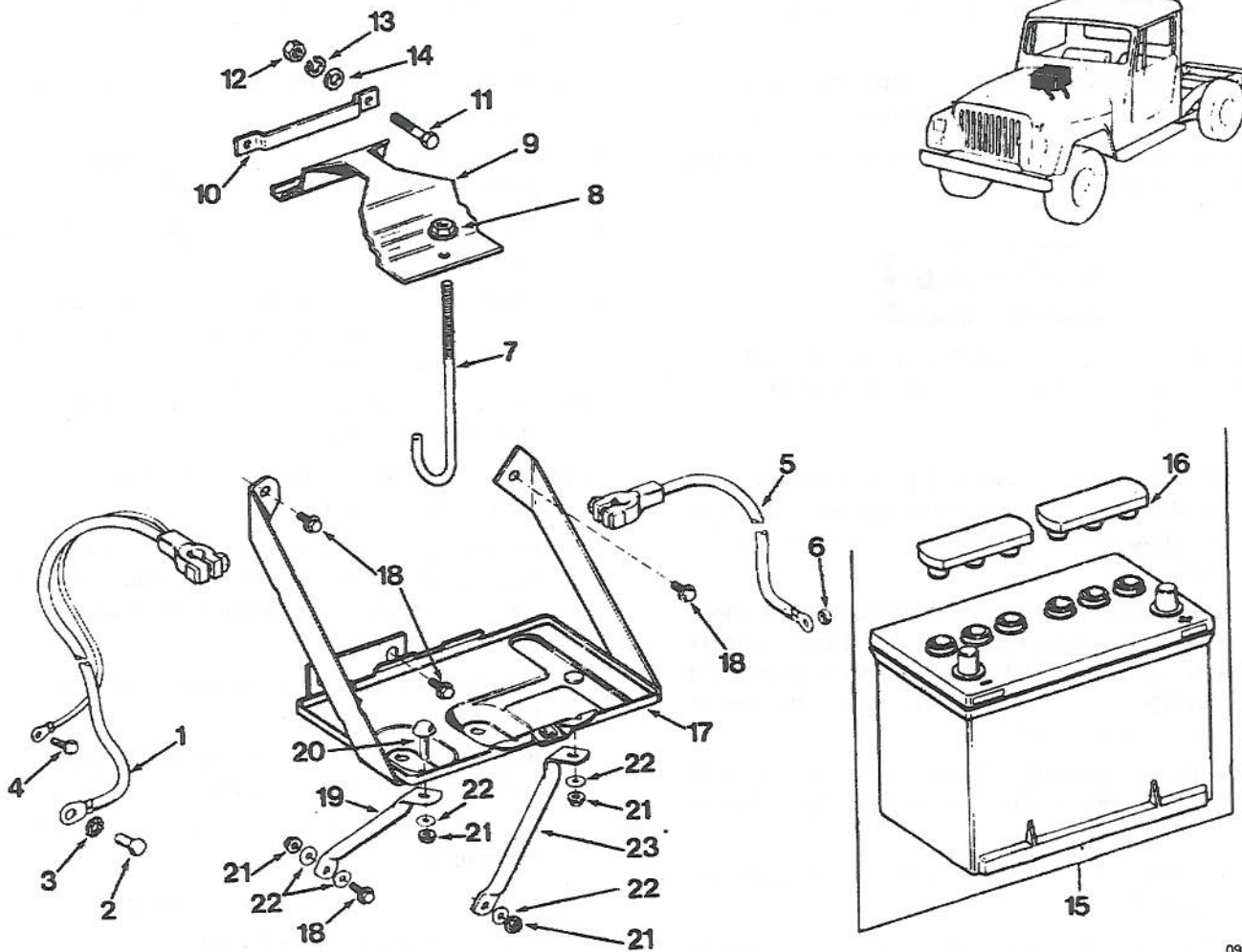
5-5.1.9 Battery and Mounting Group. Refer to figure 5-31, and perform the following steps to overhaul the battery and mounting group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove battery and mounting group as follows:

WARNING

Whenever disconnecting battery terminals, always disconnect GROUND terminal first to eliminate danger of explosion.

- (1) Remove ground cable assembly (1) from battery assembly (15).
- (2) Remove positive cable assembly (5) from battery assembly (15).
- (3) Remove locknut (8) and remove bracket hold-down (9).
- (4) Remove J-bolt (7).



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|----------------------------|----------------------|-------------------|
| 1. Ground Cable Assembly | 9. Bracket Holddown | 17. Tray Assembly |
| 2. Machine Bolt | 10. Footman Loop | 18. Capscrew |
| 3. Lockwasher | 11. Capscrew | 19. Brace |
| 4. Screw and Lockwasher | 12. Hex Nut | 20. Capscrew |
| 5. Positive Cable Assembly | 13. Lockwasher | 21. Hex Nut |
| 6. Nut and Washer | 14. Flat Washer | 22. Flat Washer |
| 7. J-Bolt | 15. Battery Assembly | 23. Brace |
| 8. Locknut | 16. Vent Cap | |

Figure 5-31. Battery and Mounting Group

WARNING

When storing battery, always wear protection (face shield), acid resistant rubber apron and gloves.

- (5) Remove battery assembly (15).
- (6) Remove vent caps (16) from battery.
- (7) Remove capscrews (11), hex nuts (12), lockwashers (13), flat washers (14) and footman loop (18).
- (8) Remove screw and lockwasher (4), machine bolt (2), lockwasher (3) and ground cable assembly (1).
- (9) Remove nut and washer (6) and positive cable assembly (5).

- (10) Remove capscrew (18), hex nut (21) and flat washers (22).
- (11) Remove capscrew (20), hex nut (21), and flat washer (22) and brace (19).
- (12) Remove hex nuts (21), washers (22) and brace (23).
- (13) Remove capscrews (18) and tray assembly (17).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition perform the following steps:
 - (1) Inspect electrolyte level in each cell of battery. Electrolyte should reach bottom of vent walls. If electrolyte is low in any cells, add distilled water until electrolyte reaches proper level.
 - (2) Inspect cables for corrosion and damage. Remove corrosion using wire brush. Damaged cables must be replaced.
 - (3) Inspect battery tray and holddowns for corrosion. Remove corrosion using wire brush. Paint any exposed metal. Any damaged components must be replaced.



Make sure vent caps are tightly secured to battery before cleaning to avoid contaminating electrolyte with cleaning solution.

- (4) Clean outside of battery case. Clean top cover with diluted ammonia/soda solution to remove acid film. Flush with clean water.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Testing. Refer to the figure 5-32, and test battery and mounting group as follows:

NOTE

Battery must be cleaned prior to testing.

- (1) Hydrometer test. This procedure tests for state of battery charge.
 - (a) Inspect paper inside hydrometer. If it is brown, hydrometer is defective and must be discarded.
 - (b) Remove battery vent caps and insert hydrometer.
 - (c) Draw in only enough electrolyte to keep the float off the bottom of hydrometer barrel with bulb released.

- (d) Test specific gravity of electrolyte in each cell. Specific gravity should be between figures specified by table 6-1.
- (e) If specific gravity of all cells is above 1.235, but variation between cells is more than 0.050, it is an indication that battery is unservicable and further testing should be performed.
- (f) If specific gravity of one or more cells is less than 1.235, recharge battery at a rate of 5 amperes until three consecutive specific gravity tests at 1-hour intervals are constant.
- (g) If cell variation is more than 0.050 at end of charge period, battery must be replaced.
- (h) When specific gravity of all cells is above 1.235 and variation between cells is less than 0.050, heavy load test may be performed. Refer to table 5-3.

Table 5-3. Specific Gravity Chart

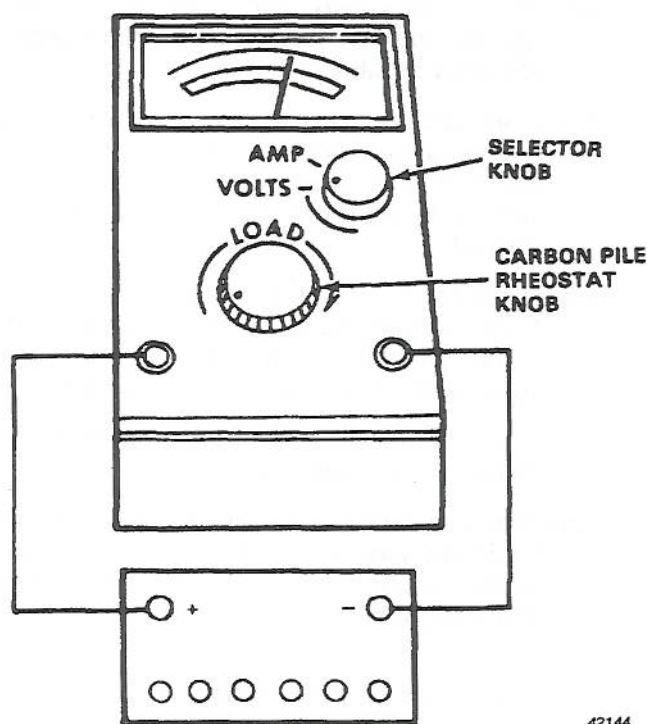
Specific Gravity State of Charge	Specific Gravity (Cold and Temperate Climates)
Fully Charged	1.265
75% Charged	1.225
50% Charged	1.190
25% Charged	1.155
Discharged	1.120

- (2) Heavy load test.

NOTE

Before performing heavy load test, battery must be fully charged.

- (a) Refer to figure 5-32 and turn carbon pile rheostat knob of battery tester to OFF position.
- (b) Turn selector knob to AMP position.
- (c) Connect test leads as shown in figure 5-32.
- (d) Turn carbon pile rheostat knob clockwise until ammeter indicates correct test amperage (refer to table 5-4.)
- (e) Maintain load for 15 seconds. Turn selector switch to VOLTS and note voltage. Voltage should be 9.6 volts or higher at minimum battery temperature of 70°F. If voltage is less than 9.6 volts, battery must be replaced.



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Figure 5-32. Heavy Load Test

Table 5-4. Test Amperages

Amperage	Battery Type
135 amperes	55-380 (75 reserve capacity minutes, 380 cold crank amps)
180 amperes	55-450 (90 reserve capacity minutes, 450 cold crank amps)
230 amperes	24-440 (135 reserve capacity minutes, 440 cold crank amps)

e. Assembly and installation. Assembly is accomplished during installation. Install battery and mounting group as follows:

- (1) Install tray assembly (17) using capscrews (18).
- (2) Install brace (23) using washers (22) and hex nuts (21).
- (3) Install brace (19) on tray assembly (17) using capscrew (20), flat washer (22) and hex nut (21).
- (4) Install brace (19) on vehicle using capscrews (18), flat washers (22) and hex nut (21).

- (5) Install positive cable assembly (5) using nut and washer (6).
- (6) Install ground cable assembly (1) using machine bolt (2), lockwasher (3) and screw and lockwasher (4).
- (7) Install footman loop (10) using capscrews (11), flat washers (17), lockwashers (13) and hex nuts (12).
- (8) Install vent caps (16) on battery.

WARNING

When servicing battery, always wear eye protection (face shield), acid resistant rubber apron and gloves.

- (9) Install battery assembly (15).
- (10) Install J-bolt (7) and bracket holddown (9) using locknut (8).

WARNING

When connecting battery terminals, always connect POSITIVE terminal first.

- (11) Connect positive cable assembly (5) to battery POSITIVE terminal. Tighten connector to torque specified by table 6-2.
- (12) Connect ground cable assembly (1) to battery GROUND terminal. Tighten connector to torque specified by table 6-2.

5-5.1.10. *Belts Group.* Refer to figure 5-33, and perform the following steps to overhaul the belts group.

a. Removal. Remove belts group as follows:

- (1) If vehicle is equipped with the optional air system, proceed as follows:
 - (a) Turn adjustment screw, located on the idler mounting pulley assembly attached to the thermostat assembly, counterclockwise.
 - (b) Remove belt from idler and air compressor pulleys.
- (2) Loosen alternator adjusting bolts and move alternator toward engine.
- (3) Remove alternator belt (1).
- (4) Loosen power steering pump belt adjusting bolts and push pump toward engine. Adjust if necessary.
- (5) Remove power steering pump belt (2).

b. Cleaning and inspection. No cleaning is required. Inspect belt for wear or damage.

c. Repair and replacement. Replace worn or damaged belts.

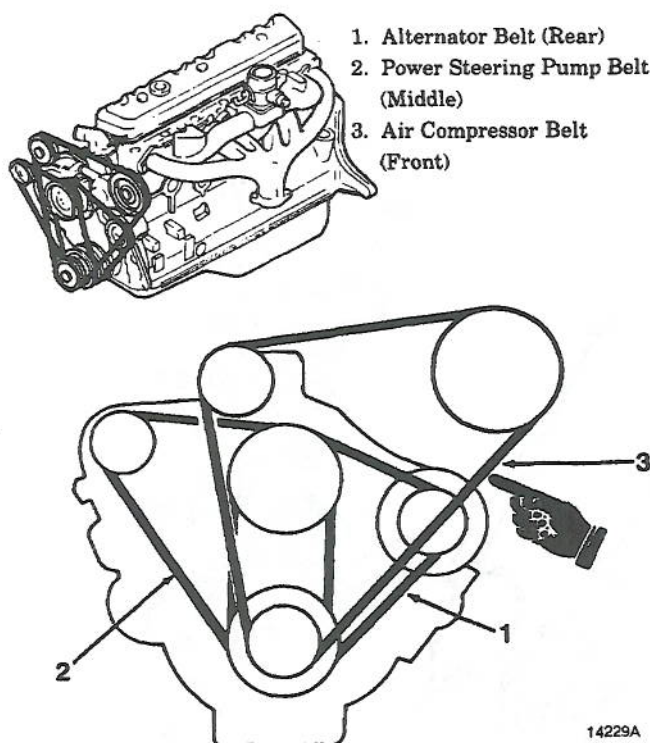


Figure 5-33. Belts Group

d. Installation. Install belts group as follows:

- (1) Install power steering pump belt (2) on pulleys.
- (2) Apply tension to power steering pump belt (2) using pry bar between engine block and power steering pump.
- (3) Check belt tension using tension gauge #J-23600.
- (4) Install alternator belt (1) on pulleys.
- (5) Apply tension to alternator belt (1) by using pry bar between engine block and alternator.
- (6) Check belt tension by applying 22 pounds pressure midway between alternator pulley and fan pulley. Belt should deflect to the figure prescribed by table 6-1.
- (7) If vehicle is equipped with the optional air system, install the air compressor belt as follows:
 - (a) Position belt according to figure 5-33.
 - (b) Apply tension to belt turning adjusting screw, located on the idler mounting pulley assembly attached to the thermostat assembly, clockwise.
 - (c) Tighten belt until a deflection of 0.3 to 0.5 inch is attained.

5-5-1.11 *Water Pump and Fan Group*. Refer to figure 5-34 and perform the following steps to overhaul the

water pump and fan group. If vehicle is equipped with the optional air system, refer to paragraph 5-5.11 for thermostat removal.

- a. Removal. Remove water pump and fan group as follows:

WARNING

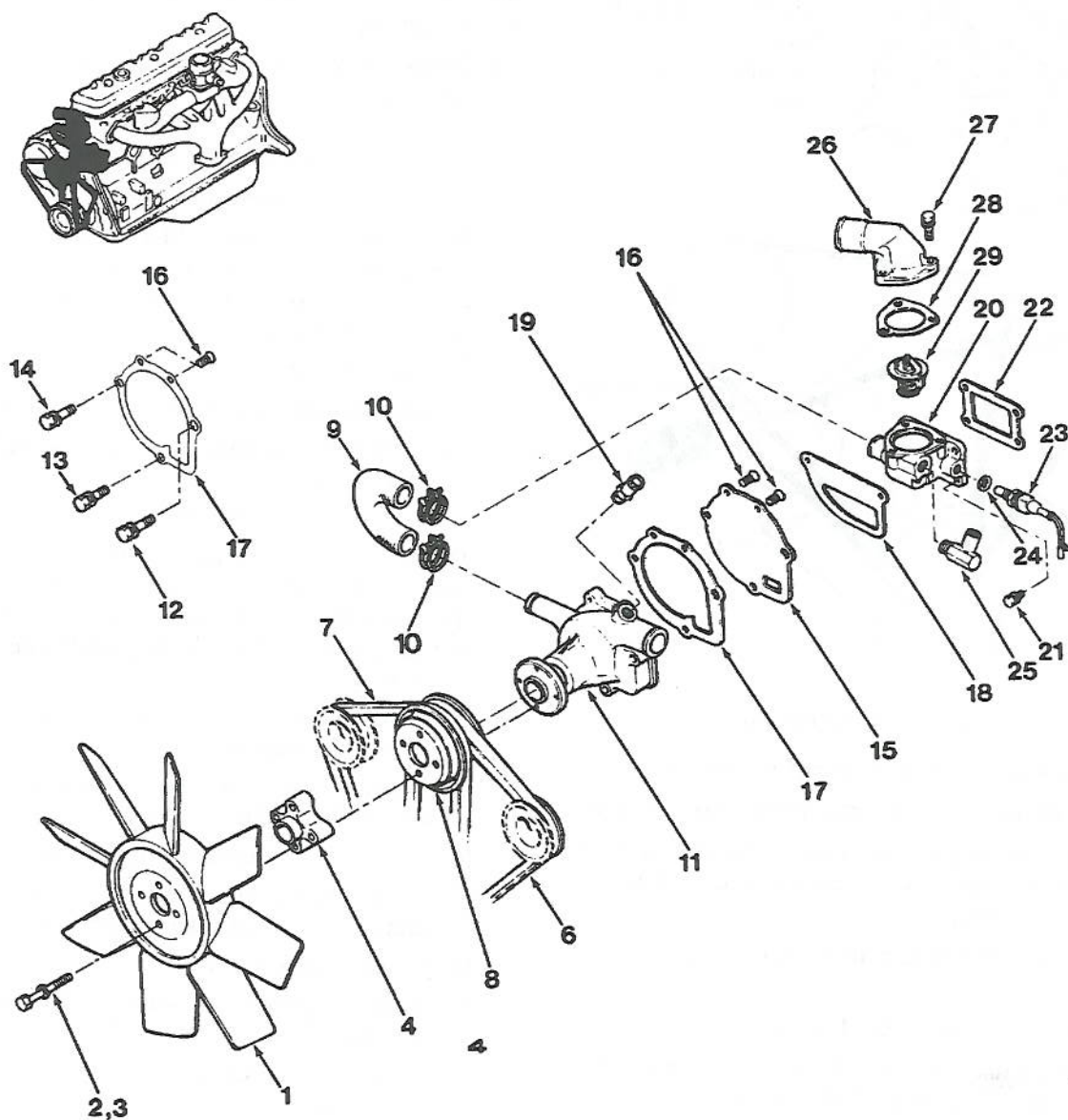
Do not remove cylinder block drain plugs or loosen radiator draincock when the system is hot and under pressure or personnel could receive serious burns.

- (1) Drain coolant.
- (2) Remove capscrew (2) and lockwasher (3).
- (3) Remove fan assembly (1), fan drive belt and fan spacer (4).

NOTE

Do not place temperature coupling on work bench with rear mounting facing downward. This may result in the unit's silicone lubricant draining into the drive bearing and being contaminated.

- (4) Remove fan pulley (8), alternator belt (6) and power steering belt (7).
- (5) Loosen hose clamps (10) and remove water hose (9) and hose clamps (10).
- (6) Disconnect radiator and heater hoses.
- (7) Remove screws and washers (12), (13), and (14), and remove centrifugal pump (11).
- (8) Remove gasket (18).
- (9) Remove screws and washers (21), thermostat housing (20) and gasket (22).
- b. Disassembly. Dissassemble water pump and fan group as follows:
 - (1) Remove connector (19).
 - (2) Remove machine screws (16), cover (15) and gasket (17).
 - (3) Remove screws and washers (27) and water outlet (26).
 - (4) Remove gasket (28) and thermostat (29).
 - (5) Remove temperature sensor (23), gasket (24) and coupling hose (25).
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:
 - (1) Check pump parts and hoses for cracking, wear or damage. If pump or hose is in any way damaged, it must be replaced.



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|-----------------------------|----------------------|------------------------|
| 1. Fan Assembly | 10. Hose Clamp | 20. Thermostat Housing |
| 2. Capscrew | 11. Centrifugal Pump | 21. Screw W/Washer |
| 3. Lockwasher | 12. Screw W/Washer | 22. Gasket |
| 4. Fan Spacer | 13. Screw W/Washer | 23. Thermostat Sensor |
| 5. (Deleted) | 14. Screw W/Washer | 24. Gasket |
| 6. Alternator Belt | 15. Cover | 25. Coupling Hose |
| 7. Power Steering Pump Belt | 16. Machine Screw | 26. Water Outlet |
| 8. Fan Pulley | 17. Gasket | 27. Screw W/Washer |
| 9. Water Hose | 18. Gasket | 28. Gasket |
| | 19. Connector | 29. Thermostat |

Figure 5-34. Water Pump and Fan Group

- (2) Clean all gasket mating surfaces.
- (3) Insert 0.003-inch feeler gauge with wire or string attached between valve and seat of thermostat (29).

WARNING

Ethylene glycol is toxic to the eyes, skin and respiratory tract. Eye and skin protection is required. Use only in a well-ventilated area.

- (4) Submerge thermostat (29) in container of pure antifreeze and suspend it so that it does not touch sides or bottom of container.
 - (5) Heat solution.
 - (6) Apply slight tension to feeler gauge. When valve opens to 0.003 inch, feeler gauge will slip out of valve. Note temperature. If temperature exceeds figure given in table 6-1 thermostat must be replaced.
- d. Repair and replacement. Replace all worn and damaged parts, including parts found defective in inspection and testing procedures.
- e. Assembly. Assemble water pump and fan group as follows:

NOTE

When installing gaskets, coat gasket with gasket sealer.

- (1) Install temperature sensor (23), gasket (24) and coupling hose (25).
 - (2) Install thermostat (29) and gasket (28).
 - (3) Install water outlet (26) using screws and washers (27).
 - (4) Install gasket (17) and cover (15) using machine screws (16).
 - (5) Install connector (19).
- f. Installation. Install water pump and fan group as follows:
- (1) Install gasket (22) and thermostat housing (20) using screws and washers (21).
 - (2) Install gasket (18).
 - (3) Install centrifugal pump (11) using screws and washers (12), (13) and (14). Tighten screws to torque specified by table 6-2.
 - (4) Connect radiator and heater hoses.
 - (5) Install water hose (9) and hose clamps (10). Tighten hose clamps (10).

- (6) Install fan pulley (8), alternator belt (6) and power steering belt (7).
- (7) Install fan spacer (4).
- (8) Install fan assembly (1) and fan spacer (4) using capscrews (2) and lockwashers (3).
- (9) Install drive belt.

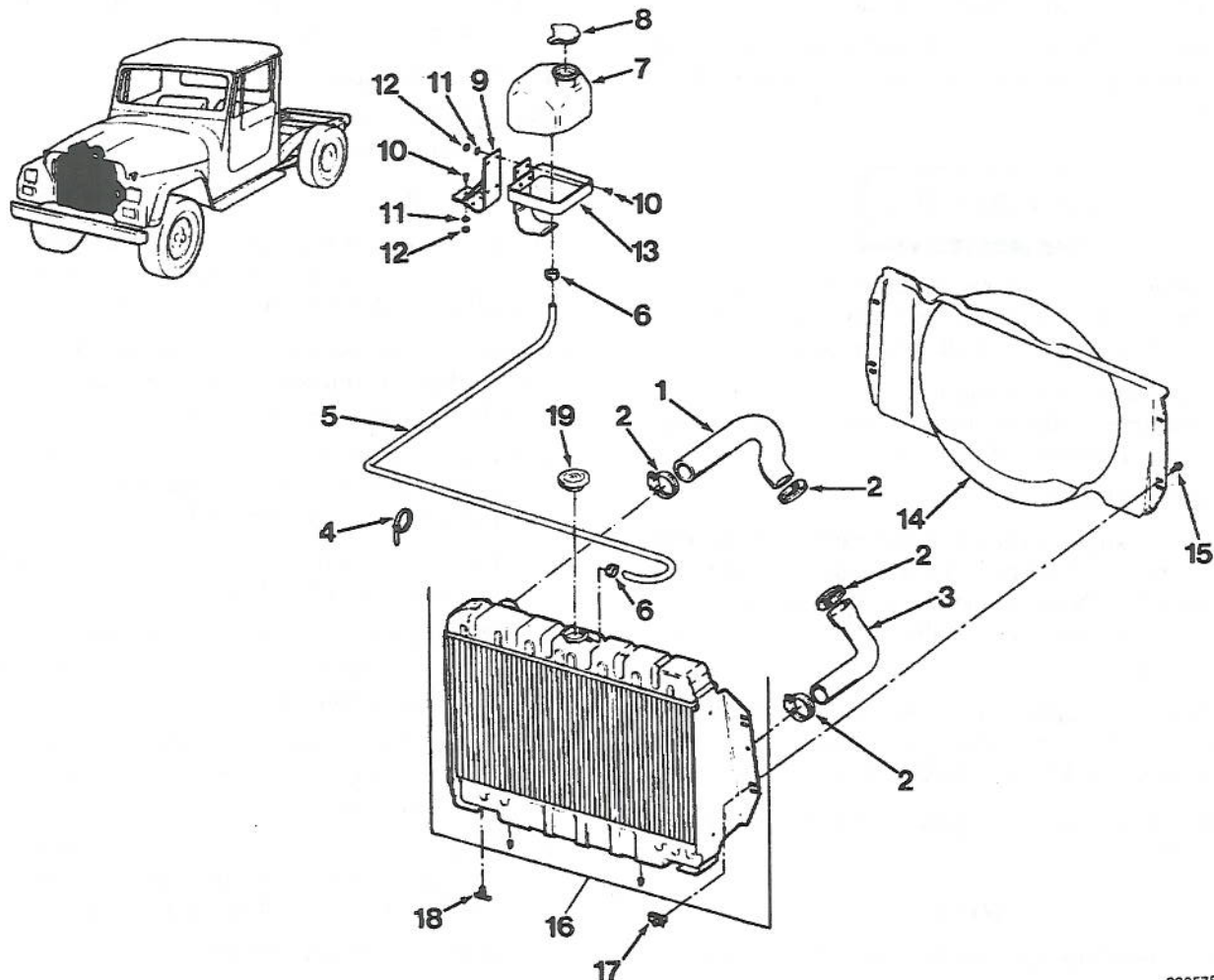
5-5.1.12 *Radiator, Hose and Coolant Recovery Group.* Refer to figure 5-35, and perform the following steps to repair the radiator, hose and coolant recovery group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove radiator, hose and coolant recovery group as follows:
- (1) Loosen hose clamp (6) and remove coolant recovery hose (5) from radiator assembly (16). Pinch hose (5) to prevent loss of coolant.
 - (2) Remove coolant recovery reservoir (7) from reservoir mounting bracket (13).
 - (3) Remove reservoir cap (8) from reservoir (7) and drain coolant from hose (5) and reservoir (7) into clean container.
 - (4) Remove hose clamp (6) at reservoir (7); remove hose strap (4) and remove coolant recovery hose (5) from reservoir (7).
 - (5) Remove machine screws (10), lockwashers (11) and hex nuts (12) holding reservoir mounting bracket (13) to bracket assembly (9).
 - (6) Remove mounting bracket (13).
 - (7) Remove machine screws (10), lockwashers (11) and hex nuts (12) holding bracket assembly (9) to vehicle body. Remove bracket assembly (9).
 - (8) Remove screws and washers (15) and U-spring nuts (17). Remove fan shroud (14).

WARNING

Do not remove cylinder block drain plugs or loosen radiator draincock with system hot and under pressure because serious burns from coolant may occur.

- (9) Position drain pan under radiator assembly (16) and remove draincock (18).
- (10) Remove radiator cap (19).
- (11) Loosen hose clamps (2) and remove inlet hose (1).
- (12) Loosen hose clamps (2) and remove lower hose (3).
- (13) Remove top radiator attaching screws.



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|---------------|---------------------|-----------------------|
| 1. Inlet Hose | 7. Reservoir | 13. Mounting Bracket |
| 2. Clamp | 8. Reservoir Cap | 14. Fan Shroud |
| 3. Lower Hose | 9. Bracket Assembly | 15. Screw and Washer |
| 4. Strap | 10. Machine Screw | 16. Radiator Assembly |
| 5. Hose | 11. Lockwasher | 17. U-Spring Nut |
| 6. Clamp | 12. Hex Nut | 18. Draincock |
| | | 19. Radiator Cap |

Figure 5-35. Radiator, Hose and Coolant Recovery Group

- (14) Disconnect and plug transmission fluid cooler pipes.
- (15) Remove bottom radiator attaching screw.
- (16) Remove radiator using sling attached to suitable lift.
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection instructions. In addition, perform the following steps:

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure should not exceed 30 psi and goggles must be worn.

- (1) Inspect radiator (16) for clogs. If clogged, clean by blowing compressed air at 3 to 5 psi from engine side of radiator through cooling fins.

- (2) Inspect radiator (16) for leaks by applying 3 to 5 psi air pressure to radiator (16) submerged in water.
- (3) Clean clogged radiator (16) with solvent or reverse flushing.
- c. Repair and replacement. Replace all worn or damaged parts. In addition, perform the following step:

WARNING

Avoid breathing fumes generated by soldering as they can be dangerous to personnel. Good general ventilation is normally adequate. Eye protection is required.

- (1) Seal all radiator leaks with solder.
- d. Assembly and installation. Assembly is accomplished during installation. Install radiator, hose and coolant recovery group as follows:
 - (1) Install radiator (16) and secure with radiator attaching screws.
 - (2) Install fan shroud (14) using screws and washers (15) and U-spring nuts (17).
 - (3) Install draincock (18).
 - (4) Remove plugs and connect transmission fluid cooler pipes.

NOTE

Use new clamps if necessary when installing hoses.

- (5) Install lower radiator hose (3) and hose clamps (2). Tighten hose clamps (2).
- (6) Install inlet hose (1) and hose clamps (2). Tighten hose clamps (2).
- (7) Install radiator cap (19).
- (8) Install bracket assembly (9) to vehicle body using machine screws (10), lockwashers (11) and hex nuts (12).
- (9) Install mounting bracket (13) on bracket assembly (9) using machine screws (10), lockwashers (11) and hex nuts (12).

NOTE

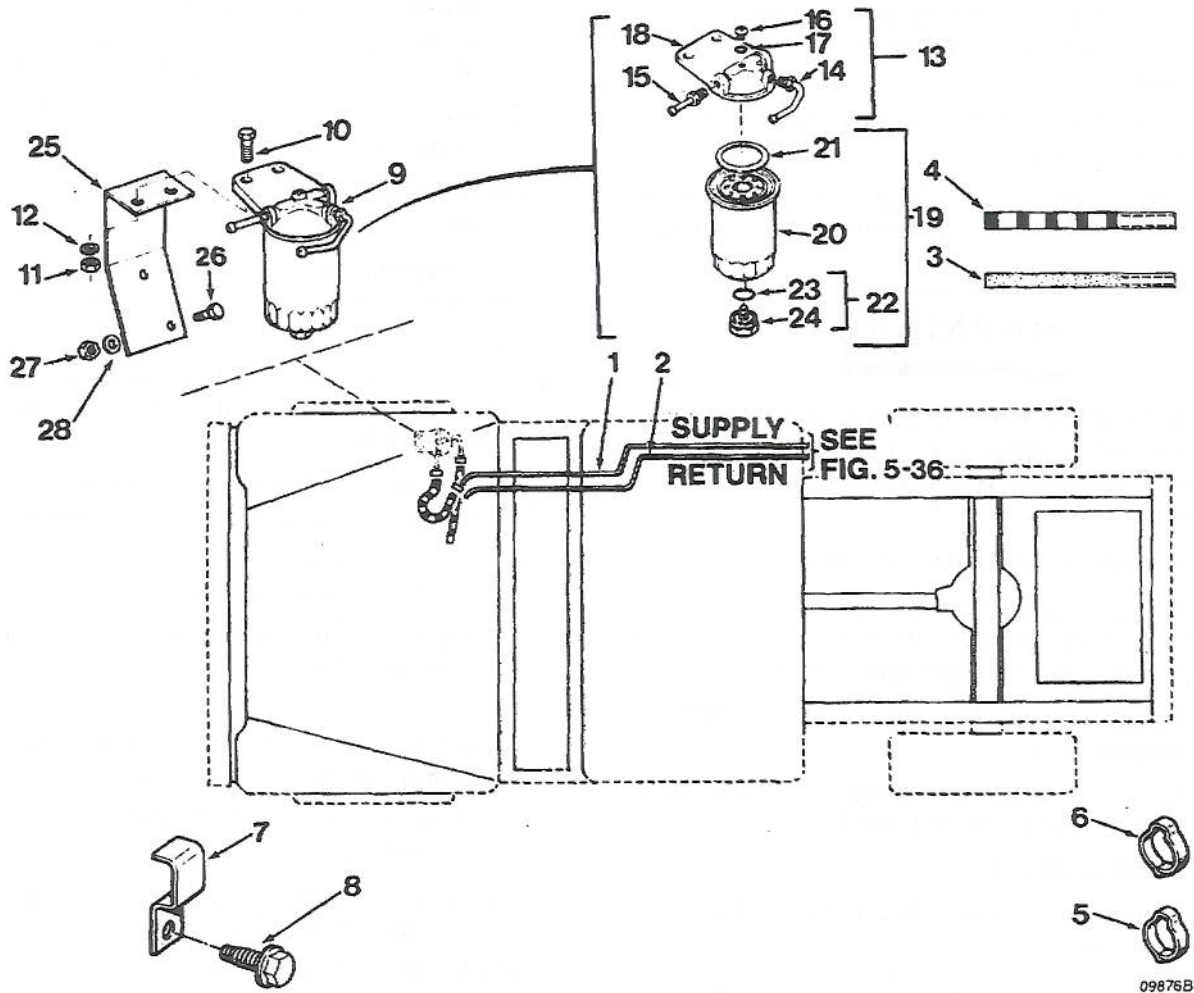
Use new clamps if necessary when installing hoses.

- (10) Install coolant recovery hose (5) and hose clamp (6) at radiator (16). Tighten hose clamp (6).

- (11) Install coolant recovery hose (5) and hose clamp (6) through reservoir mount bracket at coolant recovery reservoir (7). Tighten hose clamp (6).
- (12) Secure coolant recovery hose (5) to vehicle body using hose strap (4).
- (13) Install coolant recovery reservoir (7) and reservoir cap (8).

5-5.1.13 *Fuel Lines Group*. Refer to figure 5-36, and perform the following steps to overhaul the fuel lines group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the fuel lines group as follows:
 - (1) Loosen and remove hose clamps and remove tubes (1) and (2) from strainer assembly (9).
 - (2) Remove capscrews (10), hex nuts (11), lockwashers (12) and strainer assembly (9).
 - (3) Loosen and remove hose clamps (5) and (6) and remove fuel lines (1) and (2) from hoses (3) and (4).
 - (4) Remove machine screws (8) and clips (7) and remove fuel lines (1) and (2) from vehicle.
 - (5) Remove hose clamps (5) and (6); remove hoses (3) and (4).
 - (6) Remove capscrews (26), self-locking nut (29) and flat washer (28).
 - (7) Remove mounting bracket (25).
 - (8) Remove machine screw (16) and packing (17); remove cover assembly (13) and packing (21).
 - (9) Remove connector assemblies (14) and (15) from cover (18).
 - (10) Remove drain plug assembly (22) components-drain plug (24) and packing (23) from cartridge (19) or cartridge (20), whichever is used.
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install fuel lines group as follows:
 - (1) Install drain plug assembly (22) components-drain plug (24) and packing (23) in cartridge (19) or cartridge (20), whichever is used.
 - (2) Install connector assemblies (14) and (15) in cover (18).



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|---------------|------------------------|------------------------|-----------------------|
| 1. Tube | 8. Machine Screw | 15. Connector Assembly | 22. Plug Assembly |
| 2. Tube | 9. Strainer Assembly | 16. Machine Screw | 23. Preformed Packing |
| 3. Hose | 10. Capscrew | 17. Packing | 24. Drain Plug |
| 4. Hose | 11. Hex Nut | 18. Cover | 25. Mounting Bracket |
| 5. Hose Clamp | 12. Lockwasher | 19. Cartridge Assembly | 26. Capscrew |
| 6. Hose Clamp | 13. Cover Assembly | 20. Cartridge Assembly | 27. Self-locking Nut |
| 7. Clip | 14. Connector Assembly | 21. Packing | 28. Washer |

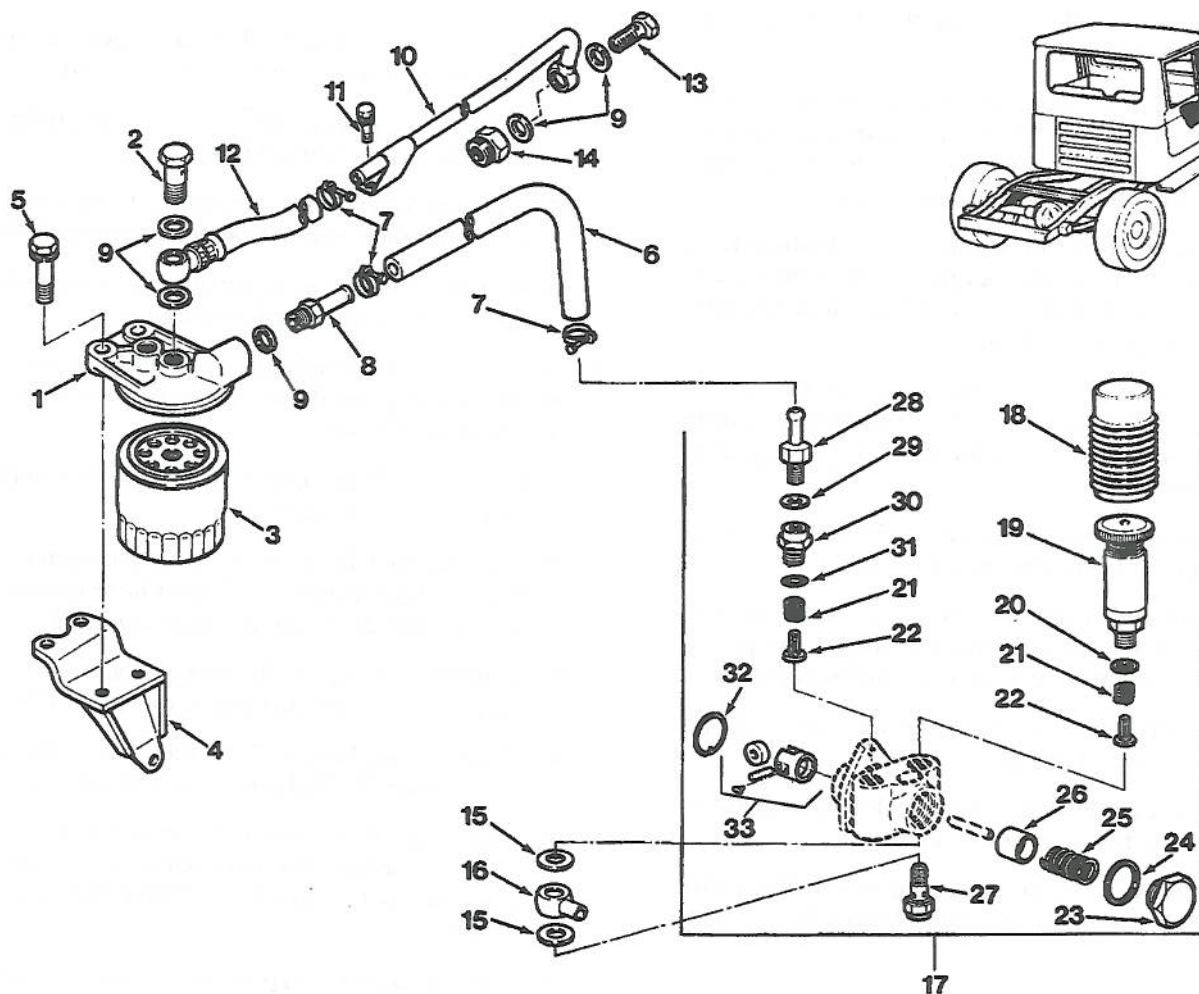
Figure 5-36. Fuel Lines Group.

- (3) Install cover assembly (13) and packing (21) using machine screw (16) and packing (17).
- (4) Install mounting bracket (25) using capscrews (26), flat washers (28) and self-locking nuts (27).
- (5) Install tubes (1) and (2) using clips (7) and machine screws (8).
- (6) Connect hoses (3) and (4) to gas tank using hose clamps (5) and (6).
- (7) Connect tubes (1) and (2) to hoses (3) and (4) using hose clamps (5) and (6).
- (8) Connect tubes (1) and (2) to strainer (9) using hose clamps (5) and (6).
- (9) Install strainer (9) using capscrews (10), lockwashers (12) and hex nuts (11).

5-5.1.14 *Fuel Pump and Fuel Filter Assembly Group.* Refer to figure 5-37, and perform the following steps to overhaul the fuel pump and fuel filter assembly group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the fuel pump and filter as follows:

- (1) Remove cover (18), priming pump (19), washer (20), check valve (22) and check valve spring (21) from top of feed pump assembly (17).
- (2) Loosen hose clamp (7) located on lower end of fuel hose (6). Remove hose joint (28), adapter (30), gasket (29), preformed packing (31),



- | | | |
|-----------------------|------------------------|-----------------------|
| 1. Cover | 12. Fuel Hose | 23. Plug |
| 2. Connector | 13. Eye Bolt | 24. Washer |
| 3. Cartridge Assembly | 14. Adapter | 25. Piston Spring |
| 4. Filter Bracket | 15. Gasket | 26. Piston |
| 5. Screw W/Washer | 16. Fuel Pipe | 27. Eye Bolt |
| 6. Fuel Hose | 17. Feed Pump Assembly | 28. Hose Joint |
| 7. Hose Clamp | 18. Cover | 29. Gasket |
| 8. Hose Connector | 19. Priming Pump | 30. Adapter |
| 9. Gaskets | 20. Washer | 31. Preformed Packing |
| 10. Fuel Pipe | 21. Check Valve Spring | 32. Tappet Ring |
| 11. Screw W/Washer | 22. Check Valve | 33. Tappet Assembly |

Figure 5-37. Fuel Filter and Fuel Pump Assembly Group

- check valve (22) and check valve spring (21) from top of feed pump assembly (17).
- (3) Remove tappet ring (32), tappet assembly (33) and push rod.
 - (4) Remove piston chamber plug (23), washer (24), piston (26) and piston spring (25).
 - (5) Remove eye bolt (27), gaskets (15) and fuel pipe (16) from the housing.
 - (6) Remove fuel filter cartridge assembly (3) from the fuel filter cover (1). Remove connector to injector pump screw (2), gaskets (9) and fuel hose (12) from the fuel filter cover (1).
 - (7) Remove screw and washer (11) and loosen hose clamp (7) from the fuel pipe (10). Remove eye bolt (13), adapter (14), gaskets (9) and fuel pipe (10) from injection pump.
 - (8) Remove hose connector (8) and gasket (9) from fuel filter cover (1). Loosen hose clamp (7) and remove fuel hose (6) from hose connector (8).
 - (9) Remove screw and washer (5) and fuel filter cover (1) from filter bracket (4).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures. In addition, perform the following steps:
- (1) Inspect fuel filter cartridge assembly (3) for clogging or damage.
 - (2) Inspect press-fitted check valve seat insert in housing for wear or damage.
 - (3) Insert push rod into housing and press in with thumb. Slight resistance should be encountered.
 - (4) Measure housing-to-piston (26) clearance. Refer to table 6-1 for clearance.
 - (5) Inspect tappet roller for scoring or wear beyond 0.587 inch.
 - (6) Measure tapped roller-to-pin clearance. Refer to table 6-1 for clearance.
 - (7) Inspect check valve springs (21) and piston spring (25) for damage or fatigue.
- c. Repair and replacement. Replace all parts found to be defective. In addition, replace the following parts if the associated conditions occur.
- (1) If press-fitted check valve seat is worn or damaged, replace housing and/or push rod.
 - (2) If slight resistance is not encountered when pressing push rod into housing with thumb, replace housing and/or push rod.
 - (3) If check valve seat is worn or scored, replace check valve (22).
 - (4) Replace piston (26) or tappet assembly (33) if worn or scored.
 - (5) If housing-to-piston (26) clearance exceeds clearance tolerance, replace piston (26).
 - (6) Replace tappet assembly (33) if tappet roller is worn or scored beyond 0.587 inch.
 - (7) If tappet roller-to-pin clearance exceeds clearance tolerance, replace tappet assembly (33).
 - (8) Replace check valve springs (21) or piston spring (25) if damaged or fatigued.
- d. Assembly and installation. Assembly is accomplished during installation. Install the fuel pump and filter as follows:
- (1) Install fuel filter cover (1) on filter bracket (4) with screw and washer (5).
 - (2) Connect fuel hose (6) to hose connector (8). Tighten hose clamp (7). Install hose connector (8) and gasket (9) on fuel filter cover (1).
 - (3) Connect fuel pipe (10) to injection pump with adapter (14), gaskets (9) and eye bolt (13).
 - (4) Connect fuel hose (12) to fuel pipe (10) with hose clamp (7). Tighten screw and washer (11).
 - (5) Install fuel filter hose (12) on fuel filter cover (1) with gaskets (9) and connector to injector pump screw (2). Install fuel filter cartridge assembly (3).
 - (6) Coat all parts of feed pump assembly (14) lightly with engine oil.

NOTE

Refer to table 6-2 for torque limits for feed pump stud bolt and feed pump locknut.

- (7) Install fuel pipe (16) with gaskets (15) and eye bolt (27) to housing of feed pump assembly (14).

NOTE

Tighten piston chamber plug slowly to assure spring remains in groove.

- (8) Install piston (26), piston spring (25), washer (24) and piston chamber plug (23) in housing.

- (9) Insert push rod and tappet assembly (33) into housing. Install tappet ring (32).
- (10) Install check valve (22), check valve spring (21), preformed packing (31), adapter (30), gasket (29) and hose joint (28) on discharge side of housing. Connect hose joint to fuel hose (6) with hose clamp (7).
- (11) Install check valve (22), check valve spring (21), washer (20), priming pump (19) and cover (18) on intake side of housing.
- e. Testing. With feed pump assembled, but not connected to fuel pipe (16) or fuel hose (6), test the following items:
 - (1) Air tightness of push rod. With discharge side closed and air pressure of 28.4 psi applied to inlet port, submerge feed pump in oil tank; no air leak should be detected in area of push rod.
 - (2) Priming pump (19). When priming pump is operated at the rate of 60 to 100 strokes per minute, the number of pumping operations needed to begin sucking fuel must be less than 25 strokes.
 - (3) Fuel feeding quantity. With a suction pipe inside diameter (I.D.) 0.315 inch by length 78.74 inch and cam lift 0.189 inch-SD22, 0.236 inch-SD33, run the pump at 1000 rpm for 15 seconds. The quantity of fuel fed must exceed 300 cc.
 - (4) Fuel feeding pressure. With a suction pipe I.D. 0.315 inch by length 78.74 inch and cam lift 0.189 inch-SD22, 0.236 inch-SD33, run the pump at 600 rpm. The time needed to reach feeding pressure of 25.6 psi must be less than 30 seconds.

5-5.1.15 *Injector Nozzles and Tubes Group.* Refer to figure 5-38, and perform the following steps to overhaul the injector nozzles and tubes group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the injector nozzles and tubes as follows:
 - (1) Remove valve (15), gaskets (16), and connector (17) from fuel filter.
 - (2) Loosen hose clamps (14) and remove fuel hose (13) from connector (17) and spill tube (1).
 - (3) Remove machine screws (1) and tube supports (2), (3) and (4).
 - (4) Remove hex nuts (12) and injector tubes (5), (6), (7), (8), (9) and (10).

CAUTION

Cover injection pump with clean rag to prevent entry of dirt which may cause damage to injection pump.

- (5) Remove nozzle and holder assemblies (19) and gaskets (18) with special tool #J99724Z5000.
- (6) Remove one gasket (20) from each of the nozzle and holder assemblies (19).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, make the following inspections:
 - (1) Inspect each nozzle and holder assembly (19) for seizure, damage or excessive discoloration.
 - (2) Inspect nozzle spray for correct pattern.
 - (3) Inspect nozzle for leaks.
- c. Repair and replacement. Replace all worn or damaged parts including all parts found defective during inspection and testing procedures above.
- d. Testing. Refer to figure 5-39, and perform operational test of nozzle and holder assembly (19) as follows:

WARNING

Diesel fuel is combustible and an irritant. Skin and eye protection are required. Good general ventilation is normally adequate. Keep away from open flame and other ignition sources.

- (1) Fill reservoir of pressure tester with filtered, clean No. 2 diesel fuel.
- (2) Mount nozzle and holder assembly (11) in pressure tester.

WARNING

The fuel spray from an injector can penetrate the skin. Fuel oil that penetrates the skin can cause a serious infection or death.

- (3) Operate tester pump for several strokes to bleed air from nozzle. Verify that fuel sprays from nozzle.
- (4) Cycle pump in smooth, even strokes at 1-second intervals and observe fuel spray pattern. Refer to figure 5-40 for correct spray pattern. Fuel should spray at an angle in thin symmetrical jet. It should not be vaporized, stepped, branched or uneven.

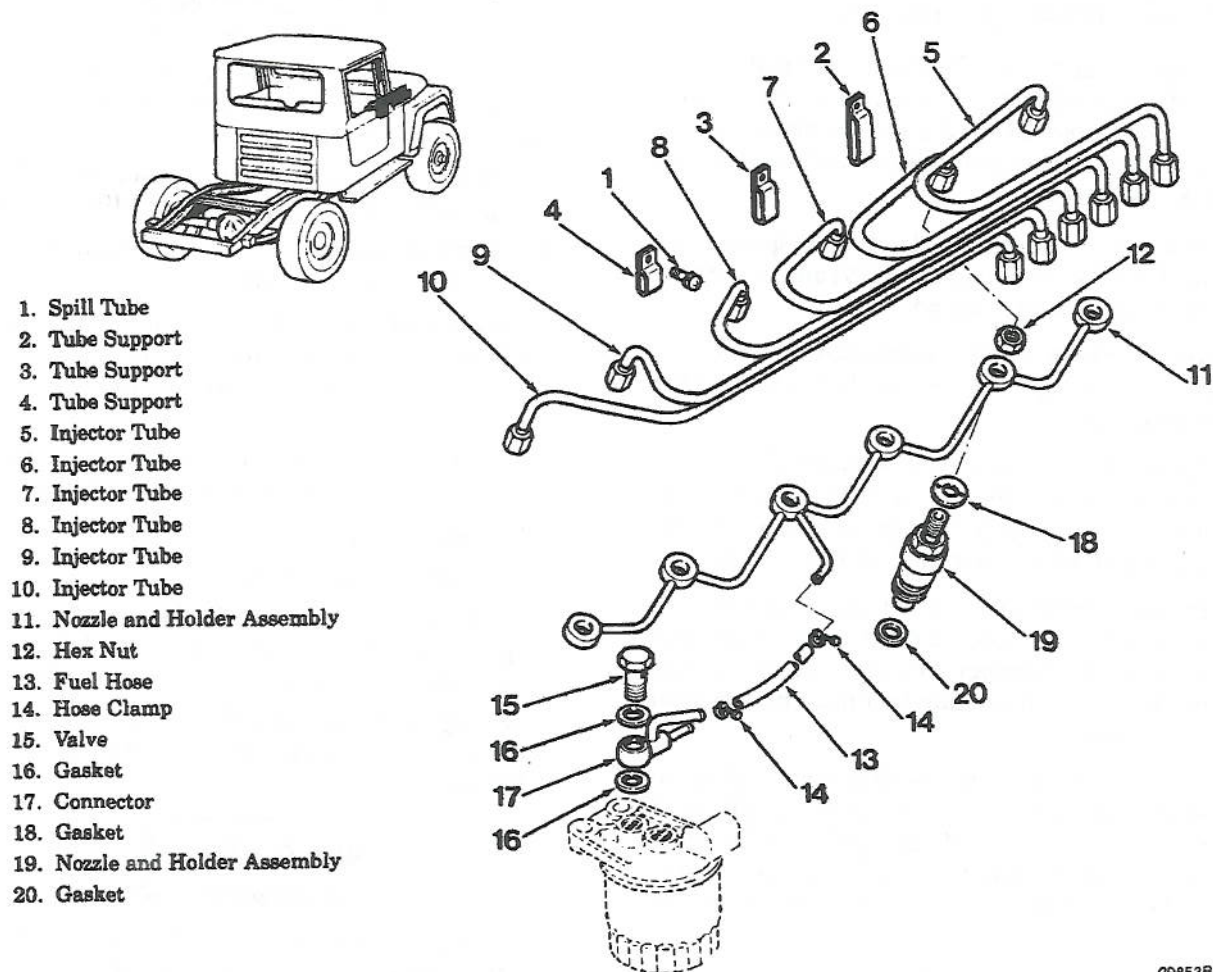


Figure 5-38. Injector Nozzles and Tubes Group

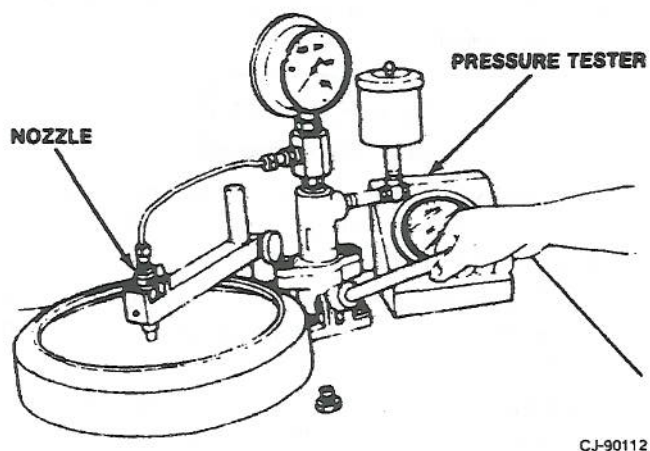


Figure 5-39. Pressure Test Setup

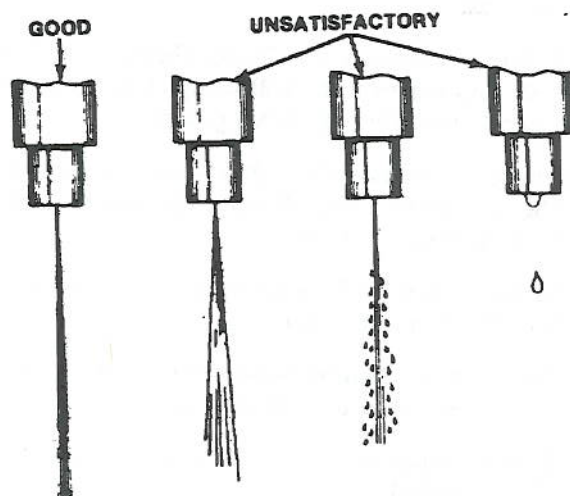


Figure 5-40. Fuel Spray Patterns

- (5) Open gauge valve on pressure tester and operate pump to check pressure at which nozzle opens. Nozzle should open at pressure specified in table 6-1.
- (6) Wipe nozzle tip dry and operate pump at 500 psi below opening pressure. Nozzle should not leak. Slight wetting is normal after about 10 seconds.
- (7) Operate pump and inspect overflow valve connection. If excessive fuel leaks or if fuel surges when pump is cycled, replace nozzle and holder assembly (19).
- e. Assembly and installation. Assembly is accomplished during installation. Install the injector nozzle and tubes as follows:
 - (1) Install gasket (20) on each of nozzle and holder assemblies (19).
 - (2) Use special tool #99724Z5000 to install hex nuts (12), gaskets (18) and nozzle and holder assemblies (19) on spill tube (11).
 - (3) Install injection tubes (5), (6), (7), (8), (9) and (10) with tube supports (2), (3) and (4) and three machine screws (1).
 - (4) Install fuel hose (13) from connector (17) to spill tube (11). Tighten hose clamps (14).
 - (5) Install valve (15), gaskets (16) and connector (17) on fuel filter.

5-5.1.16 *Oil Cooler and Filter Group*. Refer to figure 5-41, and perform the following steps to overhaul the oil cooler and filter group.

- a. Removal. Remove oil cooler and filter group as follows:
 - (1) Remove screws and washers (27) and (28).
 - (2) Remove screws and washers (35) and (36), retainers (37), oil cooler assembly (25), cover gasket (33) and oil cooler pipe (34).
 - (3) Separate oil cooler pipe (34) and oil cooler assembly (25).
 - (4) Remove screw and washer (2), capscrew (3), lockwasher (4), bracket assembly (15), gasket (5) and filter assembly (1).
- b. Disassembly. Disassemble oil cooler and filter group as follows:
 - (1) Remove screws and washers (26), (29), and (30) and clip (31).
 - (2) Remove hex nuts (44), lockwashers (45) and gaskets (46), and separate oil cooler element (47), oil cooler (32) and oil cooler housing (43).

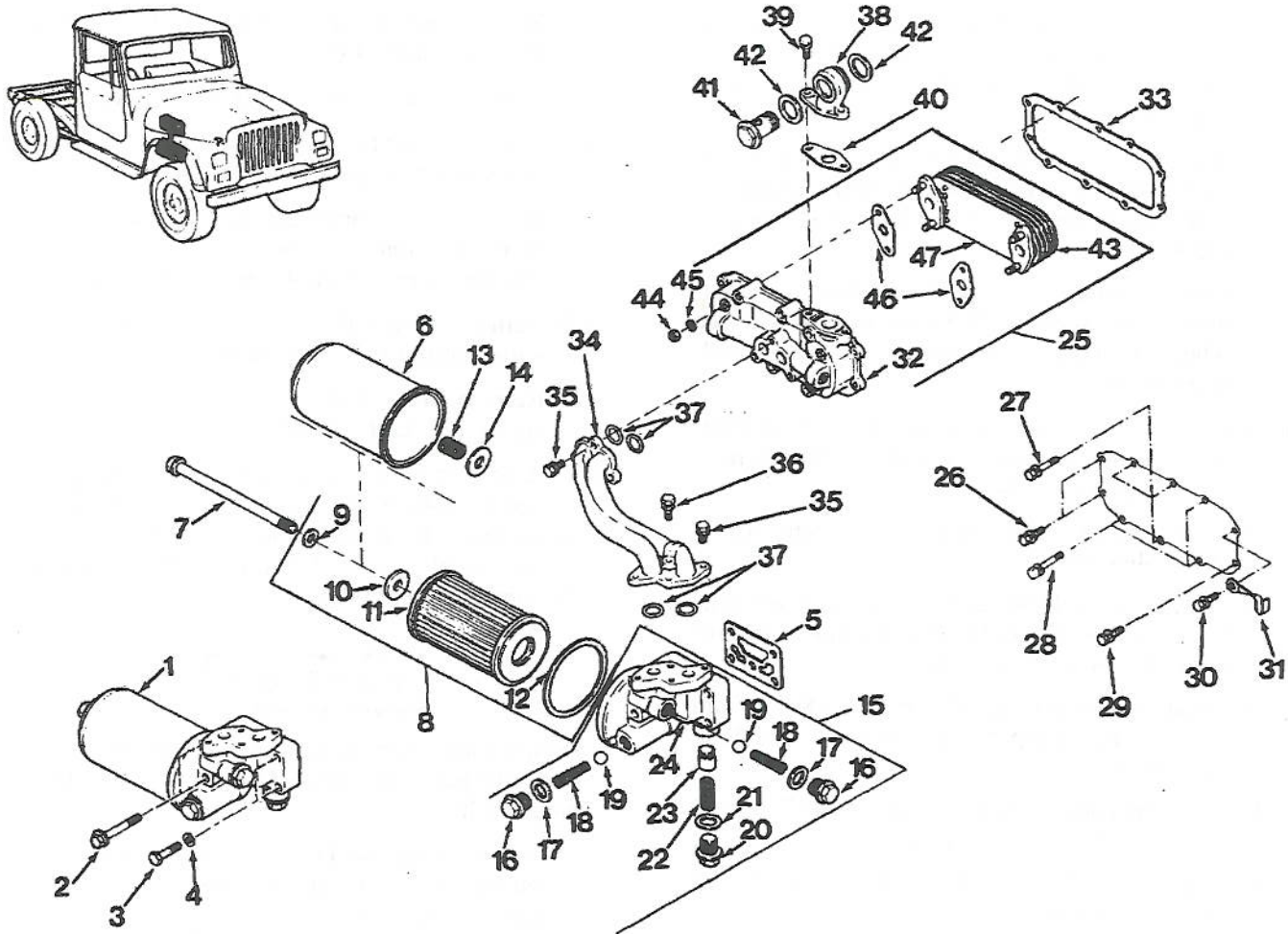
- (3) Remove screws and washers (39), connector (38) and gasket (40).
- (4) Remove connector bolt (41) and gaskets (42).
- (5) Loosen center bolt (7) and remove case (6) and element kit (8) from bracket (24).
- (6) Remove preformed packing (12), oil filter element (11), inner bolt seal (10), outer bolt seal (9), spring retainer (14) and spring set (13).
- (7) Remove plug valves (16), plug gaskets (17), valve springs (18) and valves (19).
- (8) Remove plug valve (20), plug gasket (21), valve spring (22) and valve (23).

- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, block one opening of the oil cooler element (47) with a suitable plug and immerse element (47) in water.



Do not use compressed air at a pressure higher than 140 psi or damage to oil cooler element may result.

- (1) Apply compressed air to unplugged opening of oil cooler. If air bubbles appear, element (47) must be replaced.
- (2) Check oil to see if it is dirty. If dirty, oil filter element (11) must be replaced.
- (3) Check case (6) for cracks or other damage. If damaged, it must be replaced.
- (4) Check seatings of valves (19) and (23). If valve seats or balls are scratched or if valve action isn't smooth, defective parts must be replaced.
- d. Repair and replacement. Replace all worn or damaged parts and those found defective during cleaning and inspection. In addition, perform the following steps:
 - (1) Replace preformed packing (12) and gaskets (17) and (21), regardless of condition.
 - (2) If oil filter time interval has elapsed, replace oil filter element (11). If oil is found to be dirty during cleaning and inspection, replace element (11) regardless of condition.
- e. Assembly. Assemble oil cooler and filter group as follows:
 - (1) Install valve (23), valve spring (22), plug gasket (21) and plug valve (20) in bracket (24).



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|------------------------|-------------------------|----------------------|
| 1. Filter Assembly | 17. Plug Gasket | 32. Oil Cooler |
| 2. Screw and Washer | 18. Valve Spring | 33. Cover Gasket |
| 3. Capscrew | 19. Valve | 34. Oil Cooler Pipe |
| 4. Lockwasher | 20. Plug Valve | 35. Screw and Washer |
| 5. Gasket | 21. Plug Gasket | 36. Screw and Washer |
| 6. Case | 22. Valve Spring | 37. Retainer |
| 7. Center Bolt | 23. Valve | 38. Connector |
| 8. Element Kit | 24. Bracket | 39. Screw and Washer |
| 9. Outer Bolt Seal | 25. Oil Cooler Assembly | 40. Gasket |
| 10. Inner Bolt Seal | 26. Screw and Washer | 41. Bolt |
| 11. Oil Filter Element | 27. Screw and Washer | 42. Gasket |
| 12. Preformed Packing | 28. Screw and Washer | 43. Housing |
| 13. Spring Set | 29. Screw and Washer | 44. Hex Nut |
| 14. Spring Retainer | 30. Screw and Washer | 45. Lockwasher |
| 15. Bracket Assembly | 31. Clip | 46. Gasket |
| 16. Plug Valve | | 47. Element |

Figure 5-41. Oil Cooler and Filter Group

- (2) Install valves (19), valve springs (18), plug gaskets (17) and plug valves (16).
 - (3) Install center bolt (7) in case (6).
 - (4) Install spring set (13), spring retainer (14), outer bolt seal (9), inner bolt seal (10), oil filter element (11) and preformed packing (12) on center bolt (7) inside case (6).
 - (5) Install filter assembly (1) on bracket (24) and tighten center bolt to torque specified by table 6-2.
 - (6) Install connector bolt (41) and gasket (42) in connector (38).
 - (7) Install gasket (40) and connector (38) on oil cooler housing (43) using screw and washer (39).
 - (8) Install oil cooler element (47), oil cooler (32) and gaskets (46) in oil cooler housing (43).
 - (9) Install hex nuts (44), lockwashers (45), screws and washers (26), (29) and (30), and clip (31). Tighten screws (26), (29) and (30) to torque specified in table 6-2.
- f. Installation. Install oil cooler and filter group as follows:
- (1) Install bracket assembly (15), filter assembly (1) and gasket (5) using screw and washer (2), capscrew (3) and lockwasher (4).
 - (2) Install oil cooler assembly (25) and cover gasket (33) using screws and washers (27) and (28). Tighten screws (27) and (28) to torque specified by table 6-2.
 - (3) Install oil cooler pipe (34) and retainers (37), using screws and washers (35) and (36).

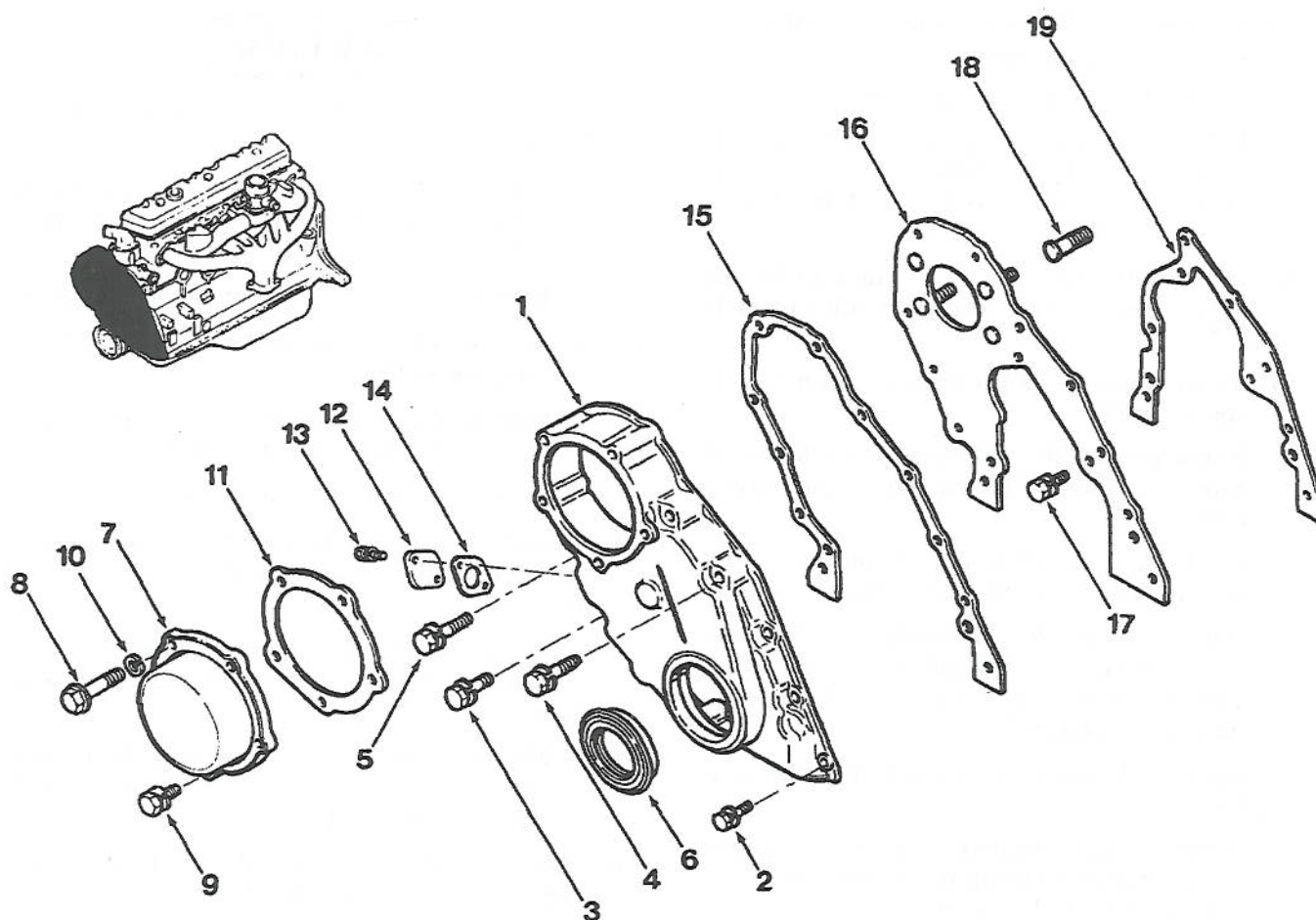
5-5.1.17 *Engine Front Cover Group*. Refer to figure 5-42, and perform the following steps to overhaul the engine front cover group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove engine front cover as follows:
- (1) Remove screws and washers (8), spring washer (10), screws and washers (9) and timing gear cover (7) with cover gasket (11).
 - (2) Refer to paragraph 5-5.1.20 and remove timing assembly.
 - (3) Lock crankshaft pulley and remove crankshaft pulley nut.
 - (4) Remove cone bushing from crankshaft pulley and remove crankshaft pulley.



Do not scratch or nick the sealing edge of the oil seal.

- (5) Remove screws and washers (3), (2), (4) and (5); and remove timing gear case (1) and gasket (15).
 - (6) Remove oil seal (6) from timing gear case (1).
 - (7) Remove screws and washers (13), cover (12) and gasket (14).
 - (8) Remove screws and washers (17), plate assembly (16) and front plate gasket (19).
 - (9) Remove injector pump bolt (18).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts. In addition, perform the following step:
- (1) Measure plate assembly (16) warp. If measurement exceeds figure prescribed by table 6-1, replace plate assembly (16).
- d. Assembly and installation. Assemble and install engine front end cover as follows:
- (1) Install injector pump bolt (18) and tighten.
 - (2) Install front plate gasket (19) and plate assembly (16) using screw and washers (17). Tighten screws to torque specified by table 6-2.
 - (3) Install cover (12) and gasket (14) on timing gear case (1) using screws and washers (13).
 - (4) Install oil seal (6) on timing gear case (1).
 - (5) Install gasket (15) and timing gear case (1) using screws and washers (3), (2), (4), and (5). Tighten screws (3), (2), (4), and (5) to torque prescribed by table 6-2.
 - (6) Install cone bushing on crankshaft pulley.
 - (7) Install crankshaft pulley nut and tighten to torque prescribed by table 6-2.
 - (8) Unlock crankshaft.
 - (9) Install timing assembly according to procedures given in paragraph 5-5.1.20.
 - (10) Install cover gasket (11) and timing gear cover (7) using screw and washer (8), spring washer (10) and screw and washer (9).



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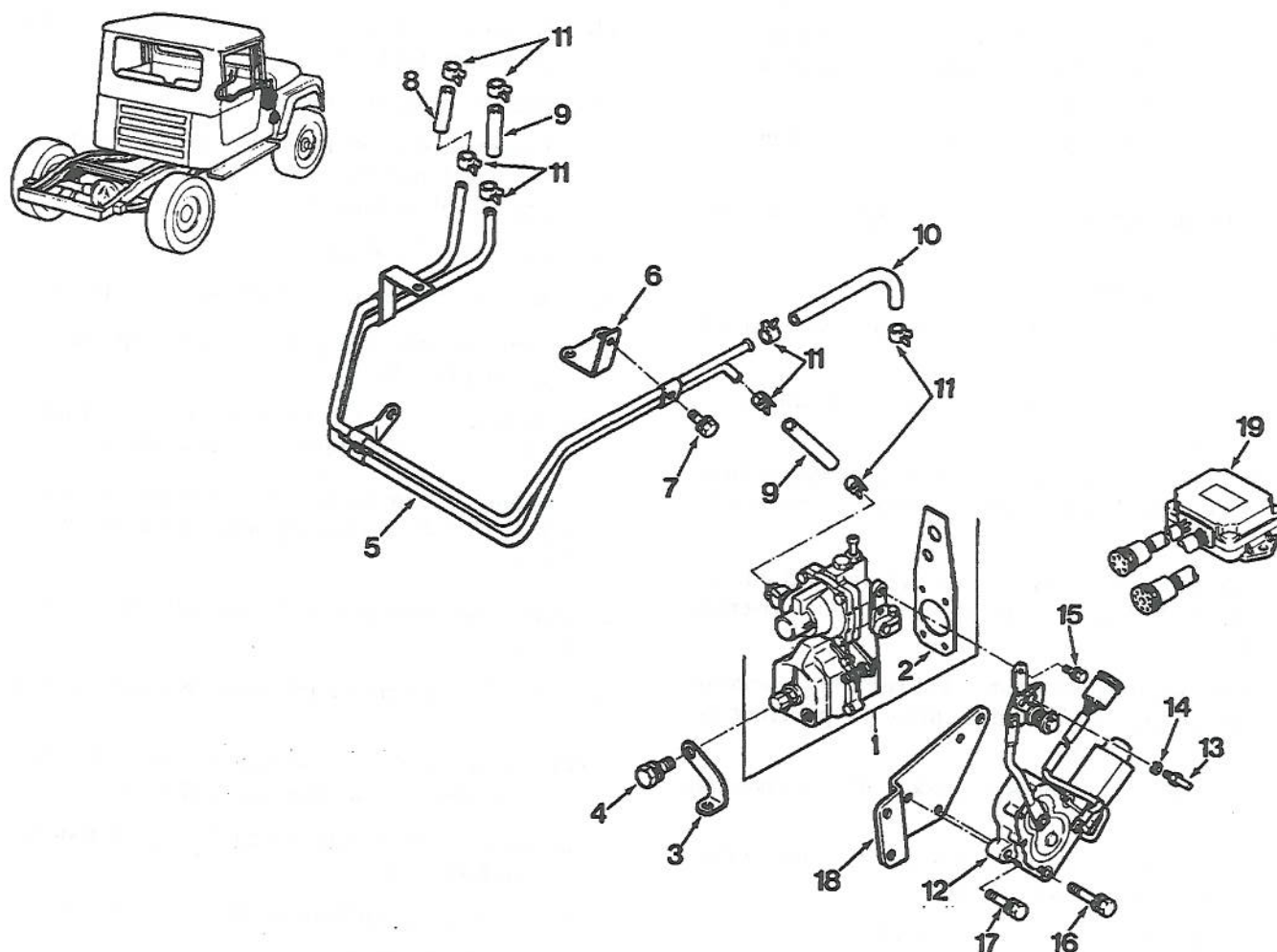
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|--------------------|----------------------|------------------------|
| 1. Timer Gear Case | 7. Timing Gear Cover | 13. Screw W/Washer |
| 2. Screw W/Washer | 8. Screw W/Washer | 14. Gasket |
| 3. Screw W/Washer | 9. Screw W/Washer | 15. Gasket |
| 4. Screw W/Washer | 10. Spring Washer | 16. Plate Assembly |
| 5. Screw W/Washer | 11. Cover Gasket | 17. Screw W/Washer |
| 6. Oil Seal | 12. Cover | 18. Injector Pump Bolt |
| | | 19. Front Plate Gasket |

Figure 5-42. Engine Front Cover Group

5-5.1.18. *Governor Assembly Installation.* Refer to figure 5-43, and perform the following steps to overhaul the governor assembly.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove the governor assembly as follows:

- (1) Remove nonmetallic hose (8) and nonmetallic hose (9) with hose clips (11) from governor tube (5).
- (2) Remove nonmetallic hose (9) and nonmetallic hose (10) with hose clips (11).
- (3) Remove screw with washer (7) and tube bracket (6).
- (4) Remove governor tube (5).
- (5) Remove injection pump controller relay assembly (19).
- (6) Remove controller bolt (13) and spring washer (14).



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|----------------------|-------------------|---------------------|
| 1. Governor Assembly | 7. Screw W/Washer | 13. Controller Bolt |
| 2. Gasket | 8. Hose | 14. Spring Washer |
| 3. Support | 9. Hose | 15. Screw W/Washer |
| 4. Screw W/Washer | 10. Hose | 16. Screw W/Washer |
| 5. Governor Tube | 11. Hose Clip | 17. Screw W/Washer |
| 6. Bracket | 12. Controller | 18. Bracket |
| | | 19. Relay Assembly |

Figure 5-43. Governor Assembly Installation

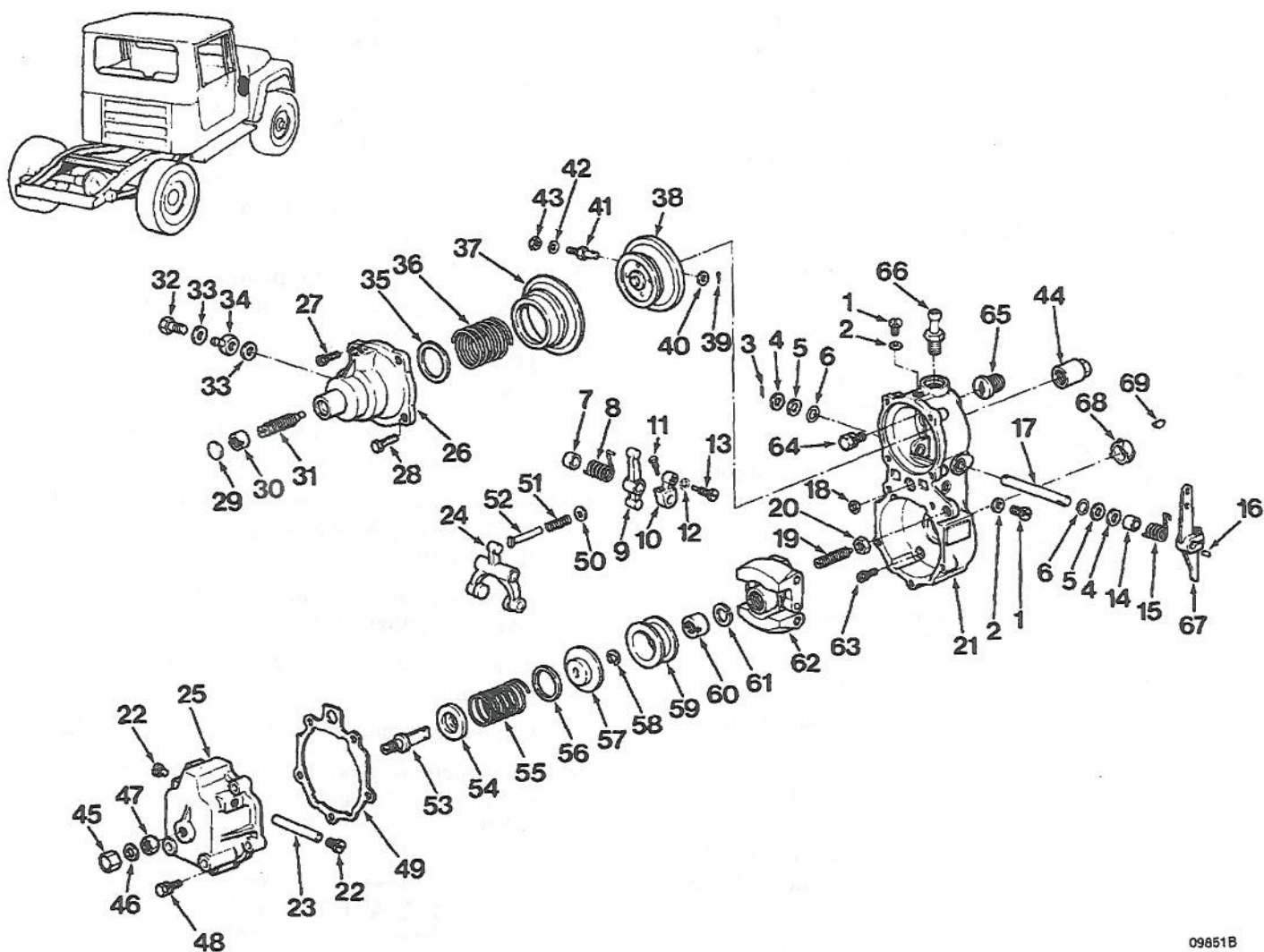
- (7) Remove screw and washers (15),(16) and (17), injection pump controller (12) and controller bracket(18).
 - (8) Remove screw and washer (4) and injection pump support (3).
 - (9) Remove governor assembly (1) and gasket (2).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
 - f. Assembly and installation. Assembly is accomplished during installation. Install the governor assembly as follows;
 - (1) Install gasket (2) and governor assembly (1).
 - (2) Install injection pump support (3) and screw with washer (4).

- (3) Install controller bracket (18) and injection pump controller (12), using screw and washers (15), (16) and (17).
- (4) Install spring washer (14) and controller bolt (13).
- (5) Install injection pump controller relay assembly (19).
- (6) Install governor tube (5).
- (7) Install tube bracket (6) and screw with washer (7).
- (8) Install nonmetallic hose (9), nonmetallic hose (10) and hose clips (11).
- (9) Install nonmetallic hose (8), nonmetallic hose clips (9) and hose clips (11) on governor tube (5).

5-5.1.19. *Governor Assembly.* Refer to figure 5-44, and perform the following steps to overhaul the governor assembly.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the governor assembly as follows:
 - (1) Remove cap nut (45), gasket (46) and hex nut (47).
 - (2) Remove screws (22), pin (23), capscrews (48) and push rod washer (50).
 - (3) Remove cover (25) and gasket (49).
 - (4) Remove screw (53), spring seat (54), spring (55) and shim (56).
 - (5) Remove spring seat (57), retaining ring (58), sleeve (59), nut (60) and spring washer (61).
 - (6) Remove flyweight assembly (62), housing capsule (19), nut (20), woodruff key (69) and impeller (68).
 - (7) Remove plug (29), nut (30) and capsule (31).
 - (8) Remove eye bolt (32), gaskets (33), and hose joint (34).
 - (9) Remove capscrews (27) and cover (26).
 - (10) Remove shim (35), governor spring (36) and stopper (37).
 - (11) Remove hex nut (43), spring washer (42), diaphragm screw (41), diaphragm washer (40), split pin (3) and diaphragm (38).
 - (12) Remove plugs (1) and gaskets (2).
 - (13) Remove capscrews (64), adapter (65) and hose joint (66).

- (14) Remove split pin (3), washer (4), washer (5) and preformed packing (6).
- (15) Remove governor housing shaft (17).
- (16) Remove woodruff key (16), lever (67), spring (15), bushing (14), washer (4), washer (5) and preformed packing (6).
- (17) Remove oil seal (18).
- (18) Remove capscrews (63) and governor housing.
- (19) Remove fork (24), push rod (52), spring (51) and washer (50).
- (20) Remove screw (13), lever (9), bolt (11), washer (12), lever (10), spring (8) and bushing (7).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly. Assemble governor assembly as follows:
 - (1) Install bushing (7), spring (8), lever (10), bolt (11), lever (9), washer (12) and screw (13).
 - (2) Install washer (50), spring (51), push rod (52) and fork (24).
 - (3) Install governor housing and capscrews (63).
 - (4) Install oil seal (18).
 - (5) Install preformed packing (6), washer (5), washer (4), bushing (14), spring (15), lever (67) and woodruff key (16).
 - (6) Install governor housing shaft (17).
 - (7) Install preformed packing (6), washer (5), washer (4) and split pin (3).
 - (8) Install hose joint (66), adapter (65) and capscrews (64).
 - (9) Install gaskets (2) and plugs (1).
 - (10) Install diaphragm (38), split pin (3), diaphragm washer (40), diaphragm screw (41), spring washer (42) and hex nut (43).
 - (11) Install stopper (37), governor spring (36) and shim (35).
 - (12) Install cover (26) and capscrews (27).
 - (13) Install joint (34), gaskets (33) and eye bolt (32).
 - (14) Install capsule (31), nut (30) and plug (29).



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|----------------------|----------------------|--------------|------------------------|
| 1. Plug | 18. Oil Seal | 35. Shim | 52. Pushrod |
| 2. Gasket | 19. Screw Capsule | 36. Spring | 53. Flyweight Screw |
| 3. Pin | 20. Nut | 37. Stopper | 54. Seat |
| 4. Washer | 21. Housing Governor | 38. Cover | 55. Spring |
| 5. Washer | 22. Capscrew | 39. Pin | 56. Shim |
| 6. Preformed Packing | 23. Screw Capsule | 40. Washer | 57. Seat |
| 7. Bushing | 24. Fork | 41. Screw | 58. Retaining Ring |
| 8. Spring | 25. Cover | 42. Washer | 59. Sleeve |
| 9. Lever | 26. Cover | 43. Hex Nut | 60. Nut |
| 10. Lever | 27. Capscrew | 44. Cap | 61. Washer |
| 11. Bolt | 28. Capscrew | 45. Nut | 62. Flyweight Assembly |
| 12. Spring Washer | 29. Plug | 46. Gasket | 63. Capscrew |
| 13. Screw | 30. Nut | 47. Hex Nut | 64. Capscrew |
| 14. Bushing | 31. Screw Capsule | 48. Capscrew | 65. Adapter |
| 15. Shaft Spring | 32. Bolt | 49. Gasket | 66. Joint |
| 16. Woodruff Key | 33. Gasket | 50. Washer | 67. Lever |
| 17. Shaft | 34. Joint | 51. Spring | 68. Impeller |
| | | | 69. Woodruff Key |

Figure 5-44. Governor Assembly

- (15) Install impeller (68), woodruff key (69), nut (20), capsule (19) and flyweight assembly (62).
- (16) Install spring washer (61), nut (60), sleeve (59), retaining ring (58) and spring seat (57).
- (17) Install shim (56), spring (55), spring seat (54) and screw (53).
- (18) Install gasket (49) and cover (25).
- (19) Install washer (50), capscrews (48), pin (23) and screws (22).
- (20) Install hex nut (47), gasket (46) and cap nut (45).

5-5.1.20. *Injection Pump Assembly.* Refer to figure 5-45, and perform the following steps to overhaul the injection pump assembly.

a. Removal. Remove injection pump assembly as follows:

- (1) Refer to paragraph 5-5.1.1 and remove air filter.
- (2) Loosen capnuts and remove nozzle pipe assemblies and nozzle spill tube.
- (3) Remove nozzle holder assemblies.
- (4) Refer to paragraph 5-5.1.17 and remove engine front cover.
- (5) Remove oil line between injector pump and engine block.
- (6) Remove diesel pump control bracket and "E" clip to governor control arm. Remove diesel pump control.
- (7) Remove injection pump assembly (1).

NOTE

Do not disassemble the injection pump unless steps 1-5 in paragraph c., Cleaning and Inspection, indicate overhaul is necessary.

b. Disassembly. If steps 1-5 of paragraph c., Cleaning and Inspection, indicate overhaul is necessary, disassemble the injection pump as follows.

- (1) Place special wrench #J-57916-432 in hole in timer assembly (47) to prevent turning of camshaft (45), and use socket wrench #J57914-010 with L-type handle to remove timer assembly nut (58), spring washer (59) and injection pump gasket (60) from timer assembly (47).
- (2) Lock camshaft (45) with special wrench #J57916-432 and screw projected portion of extractor tool #J-57926-511 into threaded hole

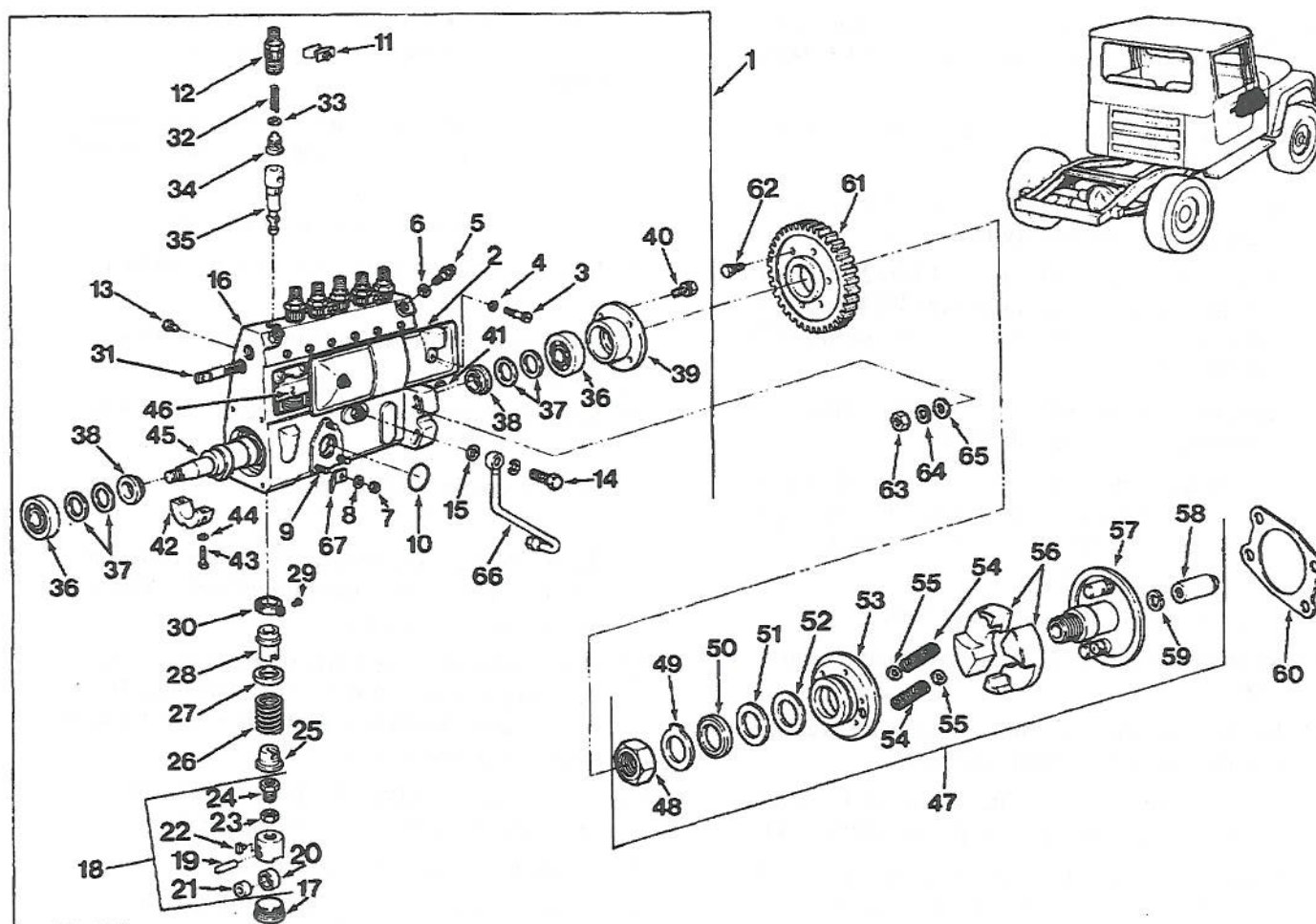
at center of flyweight holder (57). Remove flyweight (56) and flyweight holder (57).

- (3) Loosen hex nut (48) and remove springs (54), shims (55), flange (53), washer (52), shim (51), washer (50), lockplate (49) and nut (48).
- (4) Mount injection pump assembly (1) in a vise and remove hex head capscrew (3), gasket (4) and pump cover (5).
- (5) Turn camshaft (45) to lift plunger assembly (35) to top dead center. Insert tappet holder tool #J-57931-210 between tappet bolt (24) and hex nut (23) of each tappet (18). Disconnect cam and tappet (18).
- (6) Remove hex head capscrews (62) from drive gear (61). Remove drive gear (61).
- (9) Remove hex head capscrews (30) from cover (39). Press on side of bearing cover (39) to work off camshaft (45).
- (10) Lay pump housing on side and remove recessed-head screw plugs (17).
- (11) Remove screws (43) and gaskets (44) from center bushing (42).
- (12) Remove camshaft (45) with center bushing (42).
- (13) Use tappet insert tool #J-57921-012 to hold tappet assembly (18) and remove tappet holder tool #J-57921-210.



Perform procedure with care. Lay out parts on bench in proper order. Place serviceable plungers in proper plunger barrels and immerse in solvent.

- (14) Loosen tappet insert tool #J-57921-012, and withdraw tappet into camshaft chamber. Remove tappet assembly (18) with tappet clamp #J-57931-612.
- (15) Remove plunger assemblies (35) with lower spring seats (25) using plunger insert tool J-57921-412.
- (16) Remove plunger springs (26), upper spring seats (27), control sleeves (28), screws (29) and pinions (30).
- (17) Place pump housing upright and remove clamp plate (11).
- (18) Remove delivery holders (12) and springs (32).



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|----------------------------|--------------------|----------------------|---------------------------|
| 1. Injection Pump Assembly | 17. Plug | 34. Delivery Valve | 51. Shim |
| 2. Pump Cover | 18. Tappet | 35. Plunger Assembly | 52. Washer |
| 3. Capscrew | 19. Pin | 36. Bearing | 53. Flange |
| 4. Gasket | 20. Roller | 37. Shim | 54. Spring |
| 5. Air Bleed Bolt | 21. Bushing | 38. Ring | 55. Shim |
| 6. Gasket | 22. Guide | 39. Cover | 56. Flyweight |
| 7. Hex Nut | 23. Hex Nut | 40. Capscrew | 57. Flyweight Holder |
| 8. Spring Washer | 24. Tappet Bolt | 41. Woodruff Key | 58. Timer Assembly Nut |
| 9. Stud | 25. Spring Seat | 42. Center Bushing | 59. Spring Washer |
| 10. Preformed Packing | 26. Plunger Spring | 43. Screw | 60. Injection Pump Gasket |
| 11. Clamp Plate | 27. Spring Seat | 44. Gasket | 61. Drive Gear |
| 12. Delivery Holder | 28. Control Sleeve | 45. Nut | 62. Capscrew |
| 13. Rack Stop Screw | 29. Screw | 46. Plate | 63. Hex Nut |
| 14. Eye Bolt | 30. Pinion | 47. Timer Assembly | 64. Spring Washer |
| 15. Gasket | 31. Control Rack | 48. Nut | 65. Plain Washer |
| 16. Housing Assembly | 32. Spring | 49. Lockplate | 66. Oil Tube |
| | 33. Gasket | 50. Washer | 67. Clamp |

Figure 5-45. Injection Pump Assembly

- (19) Remove delivery valves (34) and gaskets (33) using delivery valve extractor tool #J-57920-032.
 - (20) From below, push plunger assemblies (35) up to remove.
 - (21) Remove rack stop screw (13) on rear of pump housing. Remove control rack (31).
 - (22) Using extractor tool #J-57920-032, remove bearing (36) from bearing cover (39) by threading in screw of extractor. Remove shims (37) and ring (38).
 - (23) Remove bearing (36), shims (37) and ring (38) from other end of camshaft (45).
 - (24) Remove, in sequence, guide (22), pin (19), bushing (21) and roller (20). Loosen hex nut (23) and remove tappet bolt (24) and hex nut (23) from tappet assembly (18).
 - (25) Remove air bleed bolt (5) and gasket (6).
 - (26) Remove eye bolt (14), gaskets (15) and oil tube (23).
 - (27) Remove O-ring (10), nuts (9), spring washers (8) and clamp (67) from studs (9).
 - (28) Remove nuts (63), spring washers (64) and washers (65) from injection pump assembly (1).
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures.



Do not allow cleaning fluid to get into delivery valve and other internal pump parts.

- (1) Check pump housing for leaks caused by cracks.
- (2) Check for leaks on upper face of pump housing due to faulty delivery valve gaskets.
- (3) Check for smooth rotation of injection pump camshaft. Rough operation indicates bearing damage or broken plunger spring.
- (4) Remove cover (5) and check interior of pump for presence of water.

NOTE

A small amount of fuel leaking past the clearance between injection pump plungers and plunger barrels is normal for lubricating parts.

- (5) Check engine oil color, viscosity and odor to determine if fuel is leaking into the lubrication

system. Check for leaks around the feed pump and for clearance between pump housing and plunger barrels.

- (6) Check plunger barrel drum for proper contact with plunger barrel seating hole, damage and cracks.
 - (7) Measure tappet-to-housing clearance.
 - (8) Inspect cams on camshaft (A) for uneven or excessive wear.
 - (9) Inspect camshaft (45) threads, taper and oil seal seating surface.
 - (10) Inspect bearings (36) for wear or discoloration.
 - (11) Inspect center bushing (42) for wear or damage.
 - (12) Turn plunger assembly (35) upside down and tilt 60°. Let plunger slide through barrel. Plunger should slide smoothly.
 - (13) With finger blocking lower part of delivery valve seat, press down on delivery valve (34). If delivery valve (34) falls to seat and does not spring back up, piston is worn.
 - (14) Inspect tappet, roller (20), bushing (21), pin (19) and guide (22) for wear and damage.
 - (15) Measure tappet bolt (24) recess.
 - (16) Inspect control rack for warp and damage.
- d. Repair and replacement. Replace all worn or damaged parts. If camshaft (45) end play exceeds specification, adjust as follows:

- (1) Remove cover (39), bearing (36) and camshaft (45).

NOTE

Use same thickness of shims on each end of camshaft.

- (2) Add or take away shims (37) to bring end play within specifications.

e. Assembly. Assemble injection pump as follows:

- (1) Apply thin coat of engine oil to all moving parts.
- (2) Apply nondrying liquid gasket material to injection pump housing and cover (39) interface.
- (3) Clamp pump housing in universal vise.
- (4) Turn plunger assembly (35) escape port toward front of pump housing and install plunger assembly (35) so that groove is aligned with knock pin in housing.

- (5) Place gasket (33) on delivery valve (34) with gasket facing part down.
 - (6) Install delivery valve (34) on top of plunger assembly (35) and, using hammer and extractor tool #J-57920-032, lightly tap into seat.
 - (7) Set delivery valve springs (32) on delivery valves (34) and install delivery holders (12).
 - (8) Install clamp plates (11) and clamp delivery holders (12).
 - (9) Install control rack (31) so that end with hole is toward timer assembly (47). Install rack stop screw (13).
 - (10) With injection pump (1) on its side, position control rack (31) so that punch marks on both sides are same distance from each end of pump housing.
 - (11) With pump still on its side, place pinion (30) and screw (29) onto end of control sleeve (28) so that slot in bottom of sleeve faces straight up.
 - (12) Install spring seat (27) and plunger spring (26) onto plunger assembly (35).
- NOTE**
- Plungers and barrels are precision matched. Make certain to maintain matches on installation.
- (13) Insert the plunger insert tool #J-57921-412 into plunger assembly (35) and slowly install the plunger and spring seat (25) into the plunger barrel, with alignment mark toward front cover (2) side of injector pump housing.
 - (14) Install roller (20), bushing (21), pin (19) and guide (22) into tappet (18).
 - (15) Using tappet insert tool #J-57921-012, install tappet (18) from bottom of pump housing. Move control rack (31) in or out until L-shaped stem of plunger assembly (35) meets notch in control sleeve (28), then press tappet (18) into position. Insert tappet holder tool #J-57931-210 between tappet bolt (24) and hex nut (23).
 - (16) Position all tappets (18) and plunger assemblies (35) so that control rack (31) slides smoothly.
 - (17) Install ring (38), shims (37) and front bearing (36) onto camshaft (45).
 - (18) Install camshaft (45) with alignment mark toward timer assembly (47).
 - (19) Apply grease to center bushing (42) and install center bushing (42), gaskets (44) and screws (43).
 - (20) Install ring (38), shims (37), bearing (36), bearing cover (39) and hex head capscrews (40) on timer side of injection pump housing.
 - (21) Use dial indicator to measure end play at timer end of camshaft by pushing shaft away from timer.
 - (22) Install plugs (17) in bottom of injection pump housing.
 - (23) Install washer (52), shim (51), washer (50), lock-plate (49), nut (48), and flange (53) on drive gear (61) with hex head capscrews (62).
 - (24) Install timer assembly (47), turn camshaft (45) and remove tappet holder tool #J-57921-210.
 - (25) Using spring balance, measure control rack (31) slide resistance with camshaft stopped. For all positions of camshaft, resistance should be less than 0.331 pound.
 - (26) Install woodruff key (41) in camshaft (35). Install springs (54), shims (55) and flyweights (56). Align flyweight (56) grooves with woodruff key (41).
 - (27) Install flyweight holder (57), timer assembly nut (58), spring washer (59) and injection pump gasket (60).
 - (28) Install gasket (6) and air bleed bolt (5).
 - (29) Install plain washers (65), spring washers (64) and hex nuts (63) on injection pump assembly (1).
 - (30) Install clamp (67), spring washers (8), hex nuts (7) and preformed packing (10) on studs (9).
 - (31) Install oil tube (66), gaskets (15) and eye bolt (14).
 - (32) Install hex head capscrews (3), gaskets (4) and pump cover (2).
- f. Testing. Test the assembled injection pump as follows:
- (1) Remove screws (3), gaskets (4) and pump cover (2).
 - (2) Remove timer assembly (47), hex head capscrews (62) and drive gear (61) from injection pump (1).

- (3) Install injection pump (1) to bed of injection pump tester.
- (4) Remove drive gear (61) from timer assembly (47) and install test coupling on timer assembly (47).
- (5) Install timer assembly (47) on injection pump (1).
- (6) Connect test coupling to drive shaft of tester, using coupling disc.
- (7) Connect hose from tester to nozzles OSD193.
- (8) Fill tester with JIS No. 2 light oil or Bosch OL6VII test oil at 95° to 113°F.
- (9) Install injection pipe (length, 23.6 inches; outside diameter, 0.236 inch; inside diameter, 0.079 inch) on tester.
- (10) Set tester nozzle injection pressure at 1422 psi and feed pump oil pressure at 22.8 psi.
- (11) Remove control rack cover and install gauge to read control rack (31) movement.

NOTE

Fuel injection starting timing is defined as the instant the plunger barrel fuel intake port is cut off by the top of the plunger. It should be adjusted to a prescribed interval. To determine this interval with a tester, the injection pump tester feeds oil at a pressure of 426.7 to 497.8 psi through the fuel intake. This pressure is sufficient to overcome the force of the fuel injection pump spring (32) and to push the delivery valve up. The injection timing is then measured, based upon the fuel discharged from the test nozzle, and is adjusted to the proper injection timing.

- (12) Attach lift gauge to tappet assembly (18) of the first cylinder from drive side.
- (13) Lower tappet assembly (18) completely (bottom dead center of camshaft) and set dial gauge to zero.
- (14) Bleed air from fuel system.
- (15) Loosen ball valve of nozzle holder during test.
- (16) Slowly turn pump tester by hand in direction of engine rotation until fuel flows from test nozzle. When fuel suddenly stops flowing, exact position for start of fuel injection has been reached.
- (17) At this point, measure tappet assembly (18) lift from bottom dead center. If fuel does not stop flowing when tappet assembly (18) is lifted

0.091 to 0.094 inch, turn tappet bolt (24) to adjust timing.

- (18) If fuel does not stop flowing when tappet (18) is lifted beyond 0.094 inch, loosen locknut and turn tappet bolt (24) counterclockwise to raise plunger.
- (19) If fuel stops before tappet (18) is lifted to 0.091 inch, turn tappet bolt (24) clockwise to lower plunger.
- (20) After adjustment, tighten tappet bolt (24).
- (21) With cam at proper setting for cylinder number 1, set angle scale mark on tester flywheel at position for testing (0° or 180°).
- (22) Use lever to turn tester flywheel 60° + 30° in direction of engine rotation. Fuel at number 4 cylinder should stop flowing. Adjust if necessary.
- (23) Check and adjust fuel injection timing in cylinder firing order as follows:

Injection Order	1	4	2	6	3	5	1
Injection Internal	60°	60°	60°	60°	60°	60°	
Scale Plate							
Indication	0°	60°	120°	180°	240°	300°	360°

- (24) After adjusting injection timing, check clearance between plunger piston pins and plunger barrels.
- (25) Position cam at top dead center and lift gauge to contact tappet (18). Set gauge scale to zero.
- (26) Lift tappet (18) with suitable tool until plunger contacts end of plunger barrel and tappet top clearance. Adjust if necessary.

g. Installation. Install injection pump assembly as follows:

- (1) Install injection pump assembly.
- (2) Install diesel pump control. Install "E" clip on governor control and install diesel pump control bracket.
- (3) Install oil line between injection pump and engine block.
- (4) Refer to paragraph 5-5.1.17 and install engine front cover.
- (5) Install nozzle holder assemblies.
- (6) Install nozzle spill tube, install nozzle pipe assemblies and tighten capnuts.
- (7) Refer to paragraph 5-5.1.1 and install air filter.

5-5.1.21 *Rocker Cover and Cylinder Head Group*. Refer to figure 5-46, and perform the following steps to overhaul the rocker cover and cylinder head group.

a. Removal. Remove rocker cover and cylinder head as follows:

(1) Remove capscrews (2), sealing washers (3) and rocker cover (1).

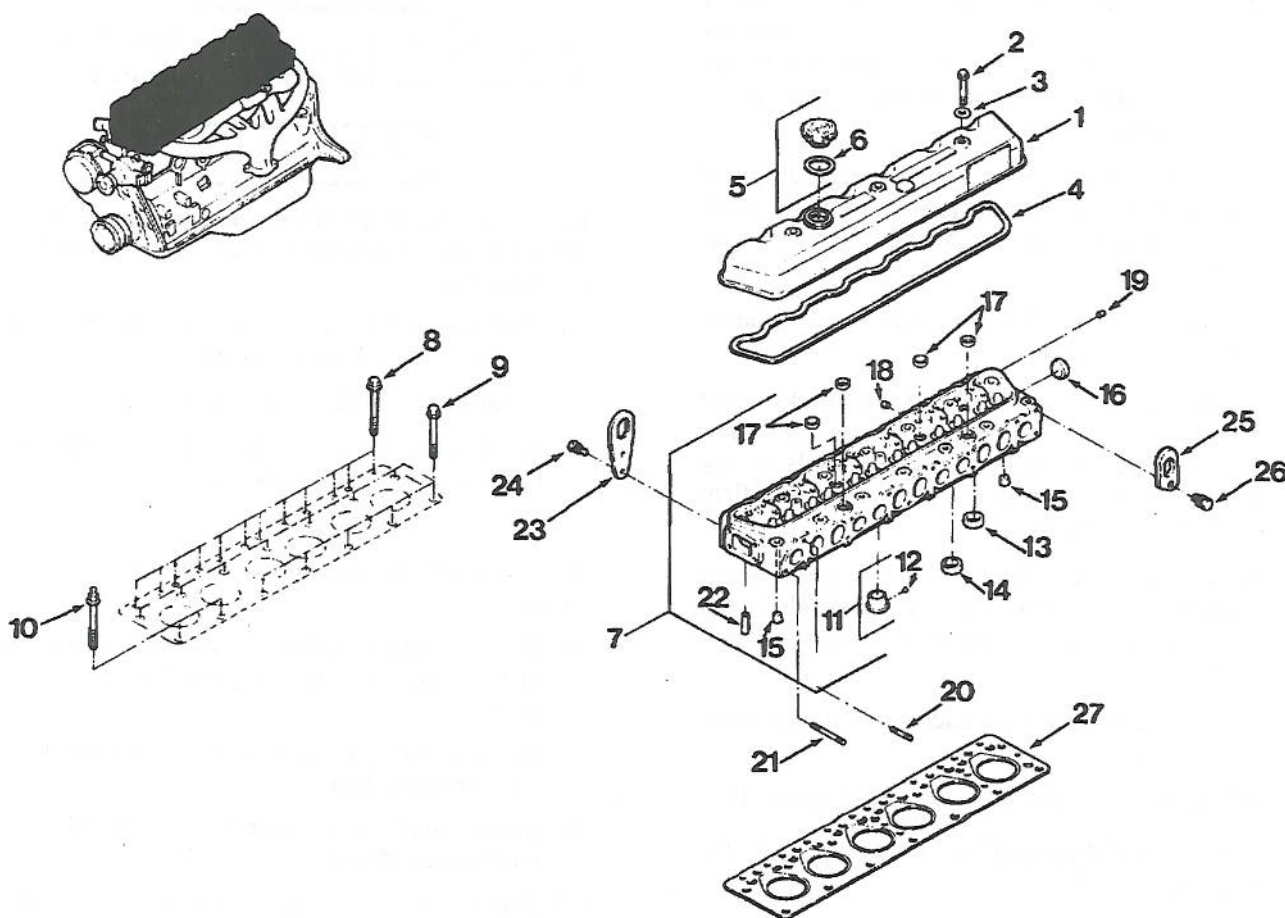
NOTE

Proceed from outside toward center of cylinder head when removing cylinder head screws.

(2) Remove screws (8), screws (9) and studs (10) from cylinder head (7).

(3) Remove cylinder head (7).

b. Disassembly. Disassemble rocker cover and cylinder head as follows:



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- | | | |
|----------------------------|----------------|----------------------|
| 1. Rocker Cover | 10. Stud | 19. Blind Plug |
| 2. Capscrew | 11. Chamber | 20. Stud |
| 3. Sealing Washer | 12. Dowel | 21. Stud |
| 4. Gasket | 13. Valve Seal | 22. Pushrod Pipe |
| 5. Oil Filler Cap Assembly | 14. Valve Seal | 23. Slinger |
| 6. Gasket | 15. Taper Plug | 24. Screw and Washer |
| 7. Cylinder Head | 16. Welch Plug | 25. Slinger |
| 8. Screw | 17. Welch Plug | 26. Screw W/Washer |
| 9. Screw | 18. Blind Plug | 27. Head Gasket |

Figure 5-46. *Rocker Cover and Cylinder Head Group*

- (1) Remove gasket (4), cap assembly (5) and gasket(6).
 - (2) Insert a 0.118 to 0.196 inch diameter bar into injector nozzle hole, and tap downward lightly to remove chambers (11). Mark chambers (11) by cylinder for proper reinstallation.
 - (3) Remove dowels (12).
 - (4) Clean carbon from valve ports.
 - (5) Insert removal tool #9969Z7000 in exhaust valve seats (13). Center tool over valve seat insert, and tighten lower nut while spreading pawls evenly around bore of insert until pawls are in firm contact with insert.
 - (6) Slide strip of copper or other soft metal under each leg of tool yoke to protect cylinder head (7), and tighten top nut of tool. Remove seat insert.
 - (7) Repeat steps 4 and 5 for each of six exhaust valve seats (13).
 - (8) Insert removal tool #9969Z7001 in intake valve seat (14). Center tool over valve seat insert, and tighten lower nut while spreading pawls evenly around bore of insert until pawls are in firm contact with insert.
 - (9) Slide strip of copper or other soft metal under each leg of tool yoke to protect cylinder head (7), and tighten top nut of tool. Remove seat insert.
 - (10) Repeat steps 4 and 5 for each of six intake valve seats (14).
 - (11) Remove taper plugs (15) and welch plug (16).
 - (12) Remove welch plugs (17), blind plugs (18) and blind plugs (19).
 - (13) Remove studs (20), stud (21) and push rod pipes (22).
 - (14) Remove slinger (23) and screws and washers (24).
 - (15) Remove slinger (25) and screw and washer (26).
 - (16) Remove head gasket (27).
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following step:
- (1) Inspect intake valve seats (14), exhaust valve seats (13) and seat recesses for stake burrs or other damage.

- d. Repair and replacement. Replace all worn or damaged parts. In addition, perform the following repair procedure:
 - (1) Remove valve seat stake burrs from intake valve seats (14) and exhaust valve seats (13).
- e. Assembly. Assemble rocker cover and cylinder head as follows:

WARNING

Dry ice will cause low temperature burns (-80°). Temperature resistant gloves are required.

CAUTION

Do not apply excessive pressure when installing chambers. Chambers must be even with cylinder head.

- (1) Chill chambers (11) in freezing solutions or dry ice for 5 to 10 minutes to shrink them.
- (2) Install dowels (12) in chambers (11).
- (3) Install chambers (11) by gently tapping into position or by using a press.

NOTE

Work quickly to maintain temperature differential.

- (4) Shrink exhaust (13) and intake (14) valve seats in freezing solution or dry ice for 5 to 10 minutes.
- (5) Install exhaust valve seats (13) with valve seat tool #99665Z7000.
- (6) Install intake valve seats (14) with valve seat tool #99665Z7001.
- (7) Stake exhaust valve seats (13) at five spots around seats.
- (8) Install head gasket (27) on engine block so that the greater metal side faces up.
- (9) Install slinger (25) and screw and washer (26).
- (10) Install slinger (23) and screws and washers (24).
- (11) Install studs (20), stud (21) and push rod pipes (22).
- (12) Install blind plugs (19), blind plugs (18) and welch plugs (17).
- (13) Install welch plug (16) and taper plugs (15).
- (14) Install gasket (6), cap assembly (5) and gasket (4).

f. Installation. Install rocker cover and cylinder head as follows:

- (1) Install cylinder head on gasket with studs (10).
- (2) Coat screws (8) and screws (9) with engine oil.
- (3) Install screws (8) and screws (9) in the sequence shown in figure 5-47. Tighten to torque values specified in table 6-2.
- (4) Install rocker cover (1), sealing washers (3) and capscrews (2).

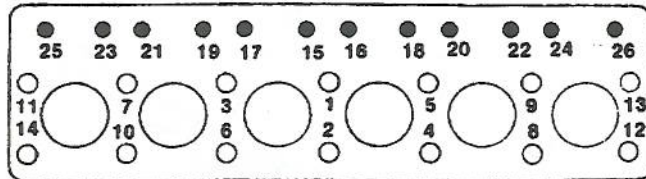


Figure 5-47. Cylinder Head Torque Sequence

5-5.1.22 *Camshaft and Valve Train Group.* Refer to figure 5-48, and perform the following steps to overhaul the camshaft and valve train group.

a. Removal. Remove camshaft and valve train as follows:

- (1) Refer to paragraph 5-5.1.21 and remove cylinder head.

NOTE

Rocker arm and related parts may be removed as an assembly and disassembled at a later time.

- (2) Remove rocker arm assembly.
 - (3) Remove nuts (26), adjusting screws (27) and push rods (28).
 - (4) Measure backlash between crankshaft gear and camshaft gear (7). Record value for future reference.
 - (5) Insert socket wrench through holes in camshaft gear (7) and idler gear (1) and remove two screws with washers (9) from locating plate (8).
 - (6) Remove camshaft (11) and locating plate (8) from block.
 - (7) Remove valve lifters (29).
- b. Disassembly. Disassemble camshaft and valve train as follows:

NOTE

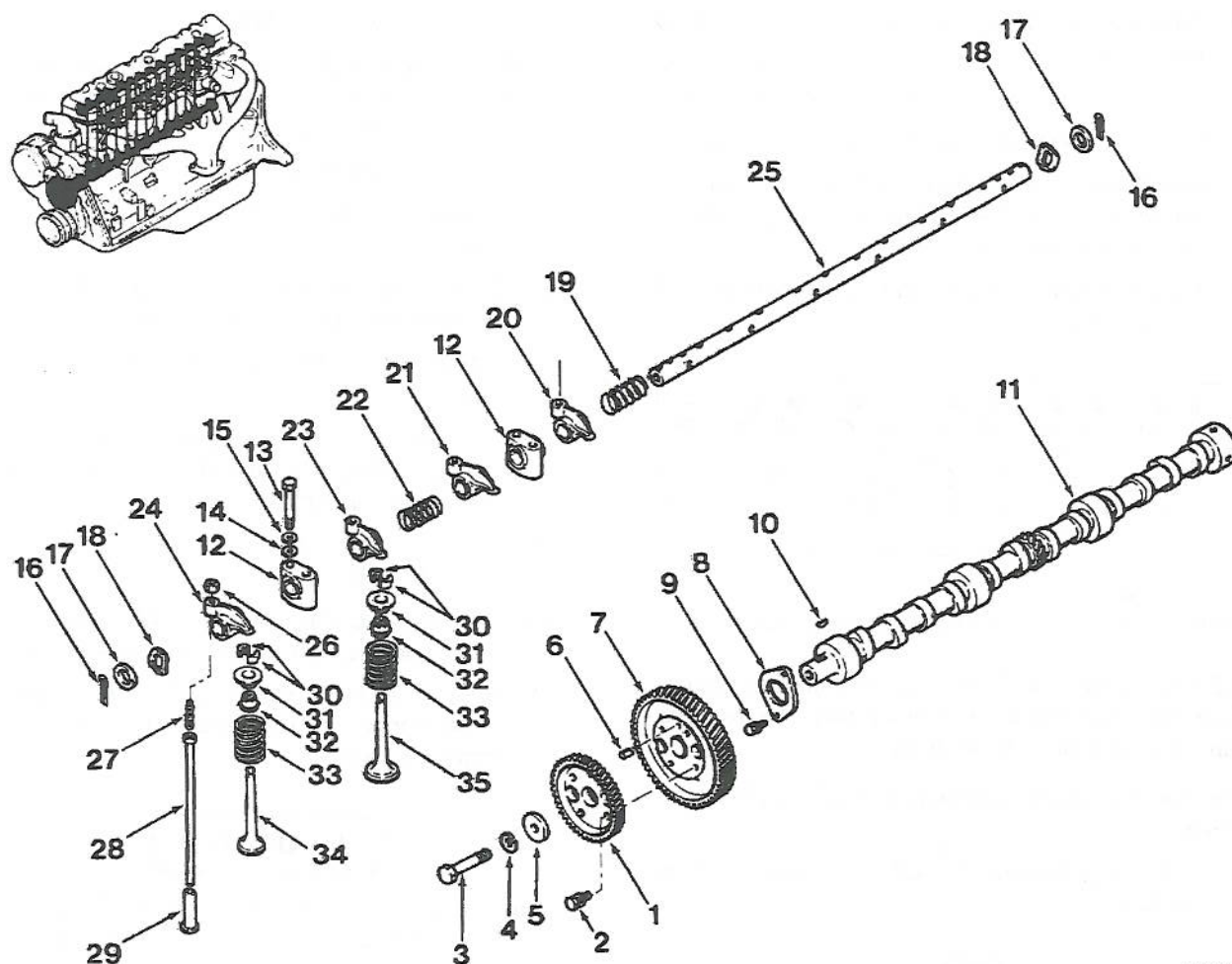
Before disassembling the camshaft, use feeler gauge to measure clearance between locating plate and camshaft gear.

- (1) Clamp camshaft in protected jaws of bench vise.
- (2) Remove capscrew (3), washer (5) and spring washer (4).
- (3) Remove screws with washers (2), idler gear (1), straight pin (6) and camshaft gear (7).
- (4) Remove locating plate (8) and woodruff key (10).
- (5) Remove split pins (16), rocker washers (17), outside springs (18) and inside springs (19) from rocker arm assembly.
- (6) Remove bolts (13), spring washers (15) and washers (14).
- (7) Using split collar tool #99624Z7000, compress valve springs (33) and remove split collars (30).
- (8) Remove exhaust valves (34), inlet valves (35), valve springs (33), valve stem seals (32) and retainers (31).



Do not use force to remove rocker brackets. Warm entire assembly to 158°F to free up brackets.

- (9) Remove rocker arm A (24), rocker arm B (23), rocker arm C (21), rocker arm D (20), rocker brackets (12), inside springs (22) and inside springs (19).
 - (10) Remove rocker shaft (25).
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:
- (1) Inspect contact surfaces of rocker valves (24) through (20) for damage and wear.
 - (2) Measure inside diameter of rocker valves (24) through (20) and outside diameter of rocker shaft (25). Difference should not exceed figure specified by table 6-1.
 - (3) Support rocker shaft (25) horizontally and measure bend. One-half dial indicator deflection represents actual bend. Bend should not exceed figure specified by table 6-1.



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- | | | |
|-------------------|--------------------|---------------------|
| 1. Idler Gear | 12. Rocker Bracket | 24. Rocker Valve A |
| 2. Screw W/Washer | 13. Capscrew | 25. Rocker Shaft |
| 3. Capscrew | 14. Plain Washer | 26. Hex Nut |
| 4. Spring Washer | 15. Spring Washer | 27. Adjusting Screw |
| 5. Plain Washer | 16. Split Pin | 28. Push Rod |
| 6. Straight Pin | 17. Rocker Washer | 29. Valve Lifter |
| 7. Camshaft Rear | 18. Outside Spring | 30. Split Collar |
| 8. Locating Plate | 19. Inside Spring | 31. Retainer |
| 9. Screw W/Washer | 20. Rocker Valve D | 32. Seal |
| 10. Woodruff Key | 21. Rocker Valve C | 33. Valve Spring |
| 11. Camshaft | 22. Inside Spring | 34. Valve |
| | 23. Rocker Valve B | 35. Valve |

Figure 5-48. Camshaft and Valve Train Group

- (4) Inspect push rods (28) and contact surfaces for wear or damage.
 - (5) Use a flaw detector or red check to check camshaft for cracks.
 - (6) Measure camshaft lobe height. Height should exceed figure specified by table 6-1.
 - (7) Support camshaft (11) horizontally and measure bend. One-half dial indicator deflection represents actual bend. Bend should not exceed figure specified by table 6-1.
 - (8) Check idler gear (1) and camshaft gear (7) for worn, damaged or broken teeth and for cracked ribs.
 - (9) Place woodruff key (10) in keyway. Inspect for play.
 - (10) Measure clearance between rocker shaft (25) and rocker valves (24) through (20).
 - (11) Measure outside diameters of lifter valve (29) and inside diameter of lifter bores in block.
- d. Repair and replacement. Replace all worn or damaged parts. In addition, make the following repairs or replacements:

- (1) If camshaft bend exceeds figure specified by table 6-1, straighten camshaft to bring it to within bend range specified by table 6-1.
- (2) If backlash between camshaft gears (7 and 1) and crankshaft gears measured during disassembly exceeds figure specified by table 6-1, replace both gears to bring backlash into tolerance range.
- (3) If difference between outer diameters of lifter valves (29) and inner diameters of lifter valve bores exceeds figure specified by table 6-1, replace lifter valves (29).

CAUTION

Do not apply heat to straighten shaft.

- (4) If rocker shaft (25) bend exceeds figure specified by table 6-1, straighten shaft in press.
- (5) If difference between inside diameter of rocker valves (24) through (20) and outside diameter of rocker shaft (25) exceeds figure specified by table 6-1, replace either or both parts.
- (6) Remove any burrs from valve seats.

CAUTION

If any part is replaced due to chipped teeth, replace mating part as it may have invisible fractures.

- (7) Replace idler gear (1) and/or camshaft gear (7) if chipped or broken teeth exist or if ribs are cracked.
- e. Assembly. Assemble the camshaft and valve train as follows:
- (1) Apply engine oil to the sliding surfaces of each component.

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi and eye protection is required.

- (2) Use compressed air to blow away any traces of dirt from surfaces that contact the cylinder head and bolt holes.

CAUTION

Do not force rocker shaft brackets onto rocker shaft. If brackets are difficult to install, warm them to 158°F before assembly.

- (3) Refer to figure 5-49, and install rocker valves (20), (21), (23), and (24), inside springs (22) and (19) and rocker brackets (12) on rocker shaft (25) in order shown.
- (4) Install inside springs (19), outside springs (18) and split pins (16).
- (5) Insert push rods (28) into valve lifters (29) with round ends down.
- (6) Install push rods (28) into rocker valves (20), (21), (23), and (24) with adjusting screws (27) and hex nuts (26).
- (7) Install inlet valves (35) and exhaust valves (34) in proper cylinders.
- (8) Install valve springs (33).
- (9) Using valve stem seal replacer tool #99674Z7000, install valve stem seals (32) on valves (35) and (34).
- (10) Install retainers (31) on valves (35) and (34).
- (11) Compress valve springs (33) and install split collars (30) using split collar tool #99624Z7000.
- (12) Install rocker shaft assembly and tighten cap-screws (13) finger tight.

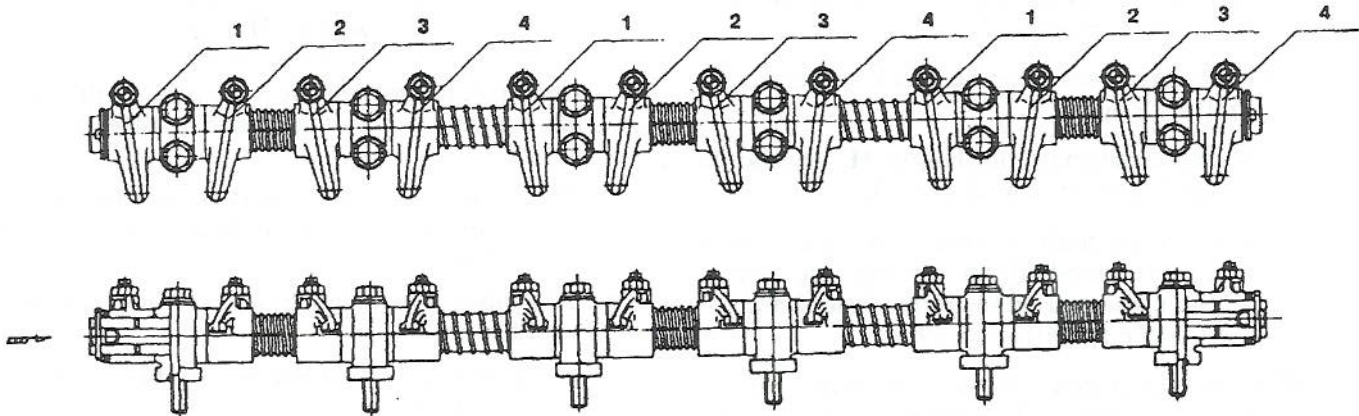


Figure 5-49. Rocker Arm, Assembled

- (13) Rotate engine while observing movement of push rod (28) and rocker valves (20), (21), (23), and (24). Correct installation of any push rod (28) that does not properly seat in valve lifters (29).
 - (14) Starting with inside capscrew, tighten capscrews (13) to torque prescribed by table 6-2 from inside to outside.
 - (15) Rotate crankshaft until both push rods of number 1 piston have free play. Number 1 piston is at TDC.
 - (16) Adjust exhaust valve (34) clearance for cylinders 1, 2 and 4 to zero. Adjust inlet valve (35) clearance for cylinders 1, 3 and 5 to zero. Perform steps (18) through (21) for the valves listed in this step.
 - (17) Loosen hex nut (26) on adjusting screw (27).
 - (18) Insert feeler gauge between valve stems (35) and (34) and rocker valves (24) through (20) when engine is cold. Measure clearance.
 - (19) Turn adjusting screw (27) until feeler gauge encounters some resistance when withdrawn.
 - (20) Hold adjusting screw (27) steady, tighten nut (26) and recheck clearance.
 - (21) Rotate crankshaft one complete turn to bring piston number 6 to TDC.
 - (22) With piston number 6 at TDC, adjust inlet valve (12) clearance for cylinders 2, 4 and 6 to zero. Adjust exhaust valve (34) clearance for cylinders 3, 5 and 6 to zero.
 - (23) Repeat steps (18) through (21) for the valves listed in step (22).
 - (24) Install locating plate (8) and woodruff key (10) on camshaft (11).
 - (25) Install straight pin (6), four screws with washers (2) and idler gear (1) on camshaft gear (7).
 - (26) Install washer (5), spring washer (4) and cap-screw (3). Tighten capscrew (3) to torque specified by table 6-2.
- f. Installation. Install camshaft and valve train as follows:
- (1) Install valve lifters (29).
 - (2) Install camshaft (11) into engine block.
 - (3) Install screws with washers (9) through holes in idler gear (6) and camshaft gear (7) into locating plate (8) with a socket. Tighten screws to torque prescribed by table 6-2.
 - (4) Install rocker arm assembly with washers (14), spring washers (15) and capscrews (13).

5-5.1.23 *Diesel Preheating Group*. Refer to figure 5-50, and perform the following steps to overhaul the diesel preheating group.

NOTE

Disconnect battery before performing maintenance/repair to the electrical system.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove (diesel preheating group as follows:

NOTE

Steps 3, 4 and 6 are not required for vehicles with glow plug controllers located inside under dash assembly.

- (1) Remove nuts connecting cable assembly electrical leads.
- (2) Remove glow plugs (1) and cable assembly (2) from cylinder head.
- (3) Remove hex nuts and washers (5) and capscrews (4); remove control splash cover (3) from right-front inner fender panel.
- (4) Remove beveled grommet (7) from control splash cover (3), and slide grommet (7) off wire.
- (5) Disconnect glow plug controller (8) wiring connector.
- (6) Remove splash cover gasket (6) from control splash cover (3).
- (7) Remove hex nuts and washers (5) and capscrews (4) from glow plug controller (8).
- (8) Remove glow plug controller (8) from right front inner fender panel or inside under dash assembly.
- (9) Disconnect wiring harness from glow plug relay (9).
- (10) Remove hex nuts and washers (5) and capscrews (10) from glow relay (9); remove glow relay (9) from right-front fender panel.

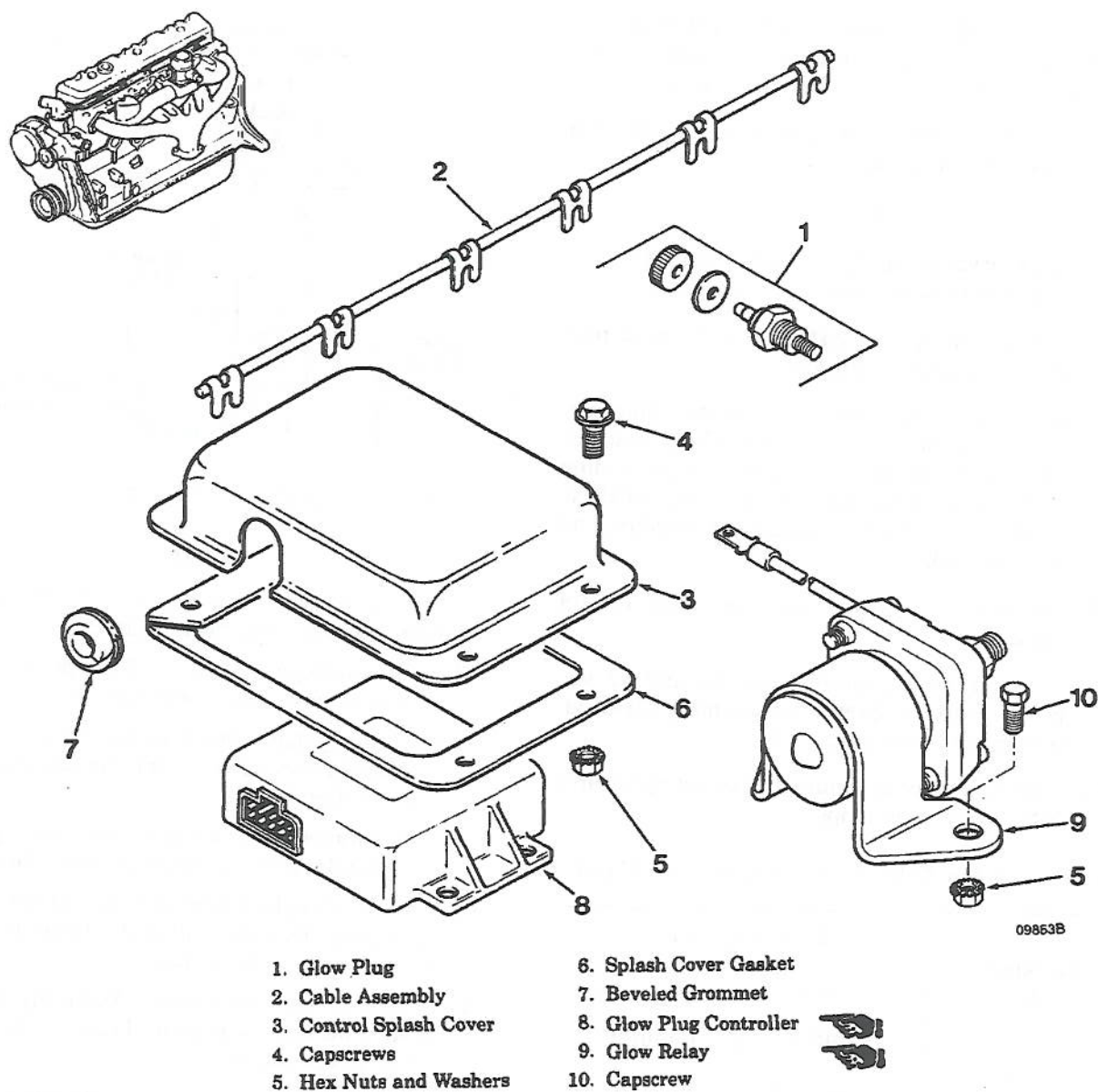


Figure 5-50. Diesel Preheating Group

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures. In addition, perform the following steps:

- (1) Visually inspect cable assembly (2) and glow plugs (1) for damage.

NOTE

Close observation of ohmmeter is required for the following low resistance specification.

- (2) Connect ohmmeter leads to body of glow plug (1) and electrical terminal.
- (3) Glow plug resistance should be the value prescribed in table 6-1. A low reading indicates glow plug insulation is faulty. A high reading indicates an open heat coil. If either of these conditions exists, glow plug (1) is defective and must be replaced.
- (4) Visually inspect glow relay assembly (9) for damage.
- (5) Connect lamps, variable resistor and 12 vdc power source to glow relay assembly (9) terminals as shown in figure 5-51.
- (6) Vary resistance at terminal 2 according to table 5-5 and observe lamps.

Table 5-5. Glow Relay Assembly Lamp Test Chart

Resistance KU	Lamp On Time (Seconds)	
	Lamp A	Lamp B
11.5	9.5 to 12.5	13 to 16
5.6	5.9 to 8.5	13 to 16
2.5	3 to 5	13 to 16
1.2	1.4 to 3	13 to 16
1.2	1.4 to 3	13 to 16
0.61	0.6 to 1.8	13 to 16

- (7) If time intervals are not as specified, glow relay assembly (9) is defective.
- (8) Visually inspect glow plug controller (8) for damage.
- (9) Connect positive side of 12 vdc power source to center wire of relay glow plug controller (8).

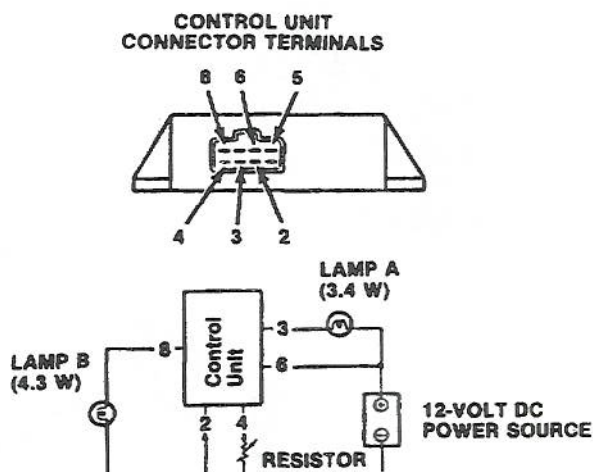


Figure 5-51. Control Unit Test Connectors

NOTE

Relay coil should energize and audible click should be heard as contacts close.

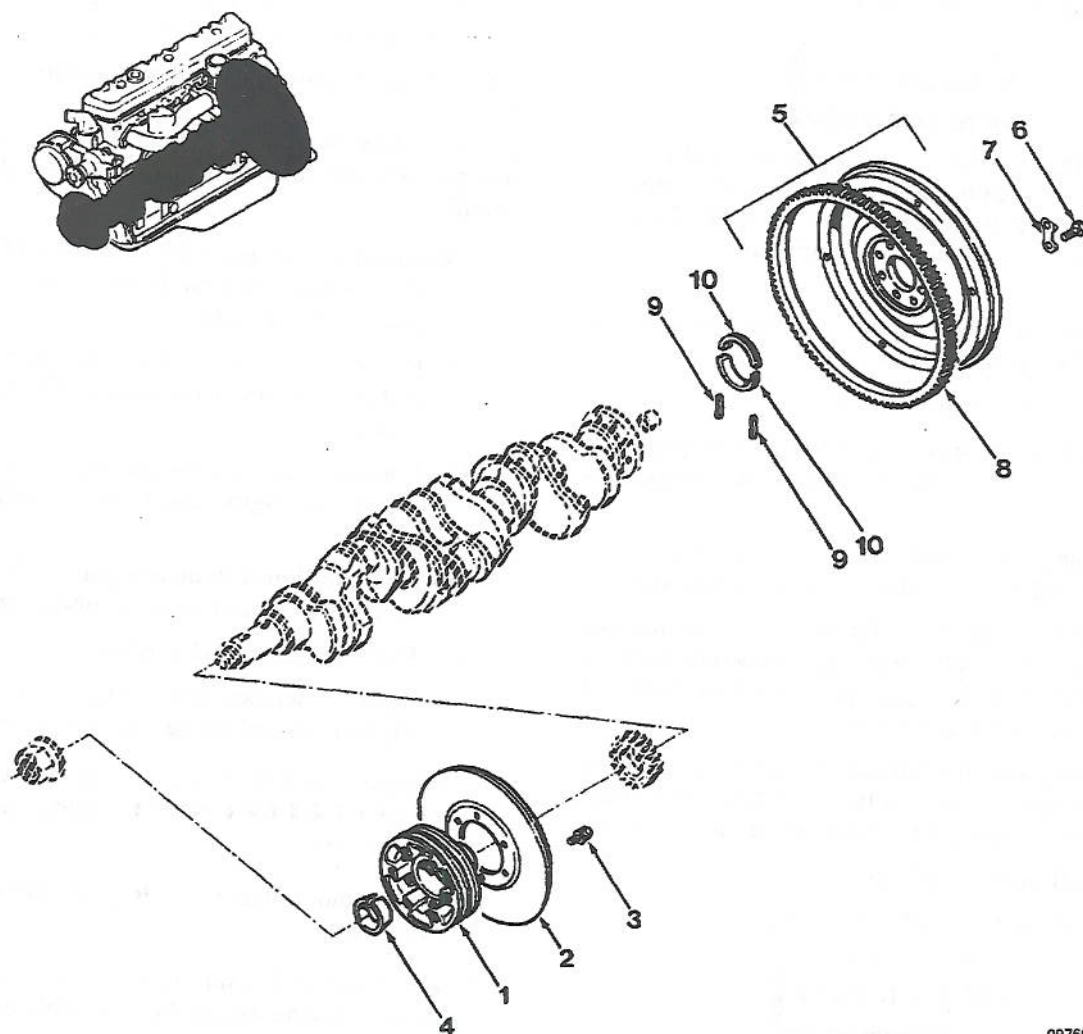
- (10) Ground negative side of 12 vdc power source to case of glow plug controller (8).
- (11) To verify that contacts are closed, connect ohmmeter between two outer terminals of glow plug controller (8).
- (12) If ohmmeter does not show continuity, glow plug controller (8) is defective and must be replaced.
- c. Repair and replacement. Replace all worn or damaged parts, including all parts found defective in inspection procedure above.
- d. Assembly and installation. Assembly is accomplished during installation. Install diesel preheating group as follows:
- (1) Install glow plugs (1) in cylinder head.
 - (2) Install electrical leads from cable assembly (2) to glow plugs (1).
 - (3) Install glow plug controller (8) on right front inner fender panel or inside under dash, using hex nuts and washers (5).
 - (4) Position the splash cover gasket (6) over the glow plug controller (8).
 - (5) Slide the beveled grommet (7) over the wiring connector, and connect the wiring connector to the glow plug controller (8).
 - (6) Position beveled grommet (7) in groove of control splash cover (3).

- (7) Position control splash cover (3) over glow plug controller (8), and install control splash cover (3) and splash cover gasket (6) using capscrews (4) and hex nuts and washers (5).
- (8) Install glow relay assembly (9) on right front inner fender panel using capscrews (10) and hex nuts and washers (5).
- (9) Connect wiring harness to glow relay assembly (9).

5-5.1.24 *Crankshaft Pulley and Flywheel Group*. Refer to figure 5-52, and perform the following steps to overhaul the crankshaft pulley and flywheel group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove and disassemble crankshaft pulley and flywheel as follows:

- (1) Lock crankshaft and remove crankshaft nut.
- (2) Remove cone bushing (4) from crankshaft pulley (1).



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|----------------------|-------------------|
| 1. Crankshaft Pulley | 6. Hex Head Screw |
| 2. Crankshaft Damper | 7. Lockplate |
| 3. Screw W/Washer | 8. Ring Gear |
| 4. Cone Bushing | 9. Oil Seal |
| 5. Flywheel Assembly | 10. Oil Seal |

Figure 5-52. Crankshaft Pulley and Flywheel Group

- (3) Remove woodruff key.
- (4) Remove crankshaft pulley (1).
- (5) Remove screws and washers (3) and crankshaft damper (2).
- (6) Remove timing gear case according to procedure given in paragraph 5-5.1.18.
- (7) Measure lateral runout of clutch disc contacting surface of flywheel, and record for future reference.
- (8) Flatten fingers of lockplates (7) and remove capscrews (6) and lockplates (7).

WARNING

When removing flywheel capscrews, hold flywheel tightly against crankshaft by hand to prevent it slipping off the crankshaft. Serious injury to personnel or damage to equipment may occur.

- (9) Remove flywheel assembly (5) and remove ring gear (8) from flywheel.
- (10) Remove oil seals (9) and (10).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace worn or damaged parts. In addition, perform the following step:
 - (1) If lateral runout of clutch disc contacting surface of flywheel (measured during removal) was greater than the figure prescribed by table 6-1, regrind or replace flywheel.
- d. Assembly and installation. Installation is accomplished during assembly. Assemble and install crankshaft and flywheel assemblies as follows:
 - (1) Install oil seals (9) and (10).
 - (2) Install ring gear (8) on flywheel.

WARNING

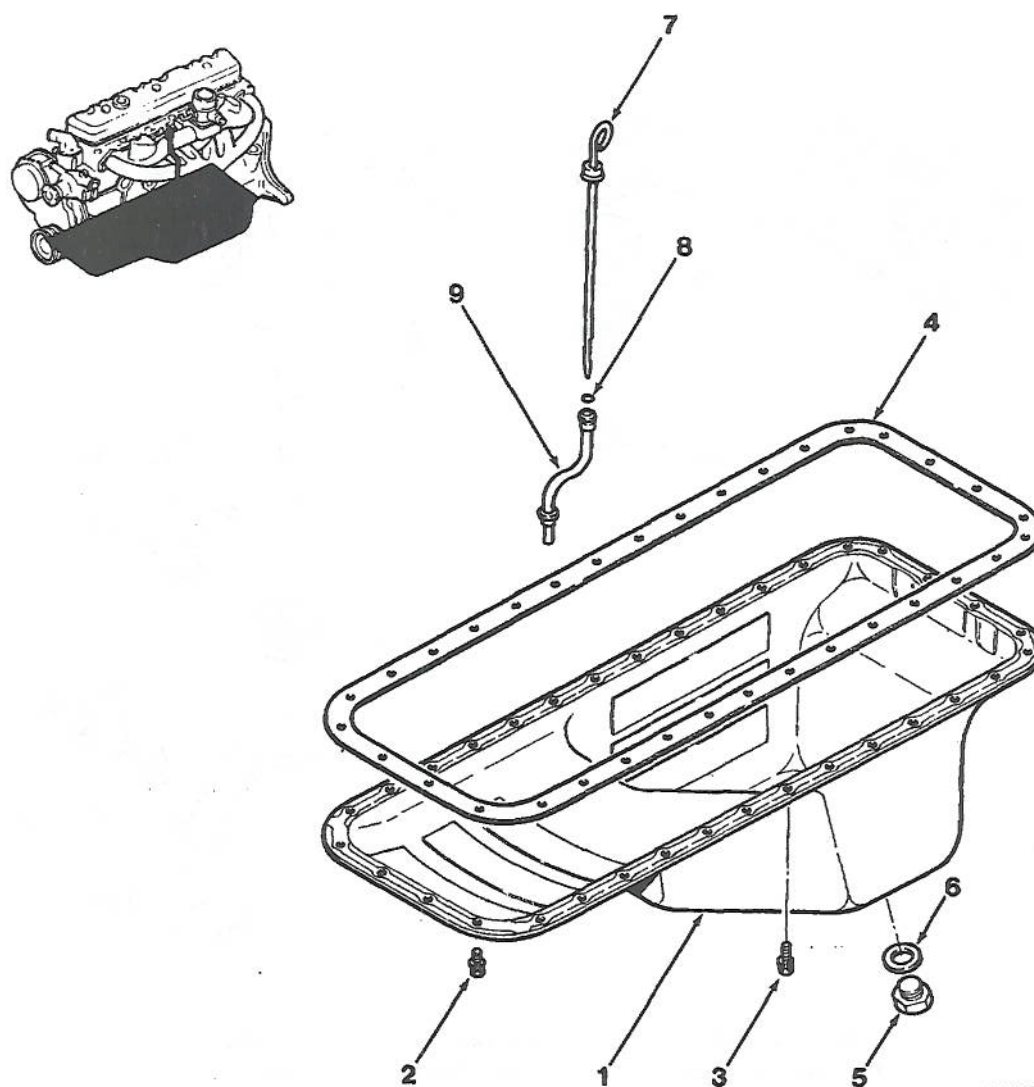
When installing hex head flywheel capscrews, hold flywheel firmly by hand to prevent it from slipping off the end of the crankshaft. The flywheel is not dowelled to the crankshaft. Serious injury to personnel or damage to equipment may occur.

- (3) Install flywheel assembly (5) by inserting hex head flywheel capscrews (6) through lockplates (7). Tighten screws to torque prescribed by table 6-2.

- (4) Bend fingers of lockplates (7) over heads of capscrews (6).
- (5) Install timing gear case according to procedure given in paragraph 5-5.1.17.
- (6) Install crankshaft damper (2) on crankshaft pulley (1) using screws and washers (3).
- (7) Insert woodruff key in crankshaft and lock crankshaft.
- (8) Install crankshaft pulley (1) and crankshaft damper (2).
- (9) Install cone bushing (4). Align opening in cone bushing (4) with woodruff key.
- (10) Install crankshaft nut on crankshaft.

5-5.1.25 *Engine Oil Pan Group.* Refer to figure 5-53, and perform the following steps to the engine oil pan group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove and disassemble engine oil pan as follows:
 - (1) Remove drain plug (5), drain plug washer (6) and drain oil from oil pan (1) into suitable container.
 - (2) Loosen connector which attaches guide assembly (9) to engine and remove guide assembly (9).
 - (3) Remove liquid indicator gauge (7) from guide assembly (9) and remove rubber ring (8).
 - (4) Remove screw and washer (3).
 - (5) Remove screws and washers (2), and remove oil pan (1) and oil pan gasket (4) from engine.
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Installation is accomplished during assembly. Assemble and install the oil pan as follows:
 - (1) Install guide assembly (9) on engine. Tighten connector.
 - (2) Install rubber ring (8) in guide assembly (9).
 - (3) Insert liquid indicator gauge (7) into guide assembly (8).
 - (4) Position oil pan (1) and gasket (4) on engine, and install using screws and washers (2). Tighten bolts to torque prescribed by table 6-2.



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|---------------------|---------------------------|
| 1. Oil Pan Assembly | 6. Drain Plug Washer |
| 2. Screw W/Washer | 7. Liquid Indicator Gauge |
| 3. Screw W/Washer | 8. Rubber Ring |
| 4. Oil Pan Gasket | 9. Guide Assembly |
| 5. Drain Plug | |

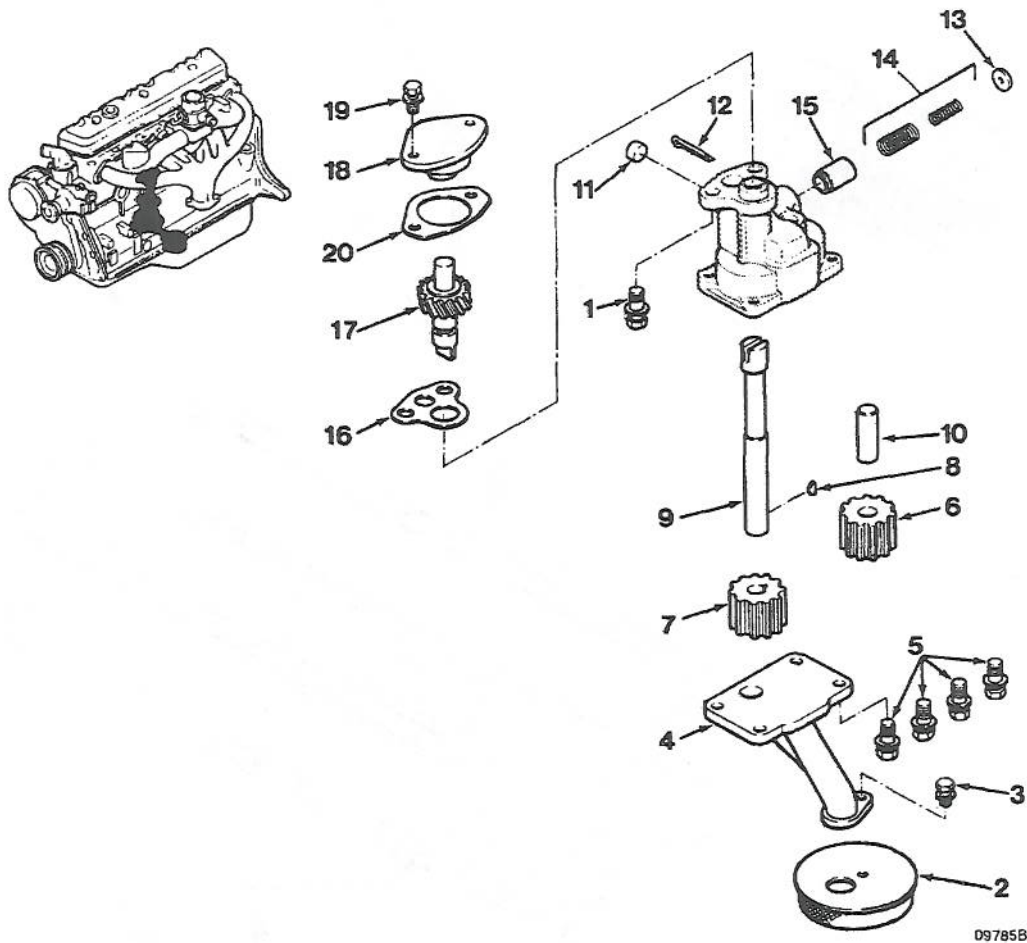
Figure 5-53. Engine Oil Pan Group

- (5) Install screw and washer (3) and tighten to torque specified in table 6-2.
- (6) Install drain plug (5) and drain plug washer (6). Tighten to torque prescribed in table 6-2.
- (7) Refill engine with oil.

5-5.1.26 Oil Pump Group. Refer to figure 5-54, and perform the following steps to overhaul the oil pump group.

a. Removal. Remove oil pump as follows:

- (1) Remove screws and washers (19).
- (2) Remove spindle support (18), support gasket (20) and spindle assembly (17).



- | | | |
|----------------------|-----------------|----------------------|
| 1. Screw W/Washer | 7. Drive Gear | 14. Spring Set |
| 2. Strainer Assembly | 8. Woodruff Key | 15. Valve |
| 3. Screw W/Washer | 9. Drive Shaft | 16. Oil Pump Gasket |
| 4. Cover | 10. Driven Gear | 17. Spindle Assembly |
| 5. Screw W/Washer | 11. Blind Plug | 18. Spindle Support |
| 6. Driven Gear | 12. Cotter Pin | 19. Screw W/Washer |
| | 13. Flat Washer | 20. Support Gasket |

Figure 5-54. Oil Pump Group

NOTE

For the following steps, engine must be turned on right side.

- (3) Remove screws and washers (1).
- (4) Remove oil pump and oil pump gasket (16).
- b. Disassembly. Disassemble oil pump as follows:
 - (1) Remove screws and washers (5) and cover (4).
 - (2) Remove strainer assembly (2) from cover (4).

- (3) Using a straight edge and feeler gauge, measure clearance between ends of gears (6) and (7) and cover (4) as shown in figure 5-55. Record measurements for future reference.
- (4) Measure clearance between tips of gear teeth and gear case at several points around drive gear (7) and driven gear (6). Record for future reference.

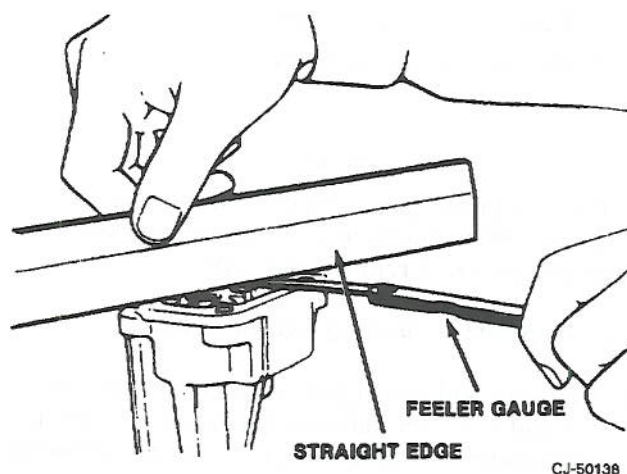


Figure 5-55. Oil Pump Cover-to-Gear Measurement

- (5) Crush length of soft solder between pump drive gear (7) and driven gear (6). Measure width of solder to measure gear backlash. Record measurement for future reference.
- (6) Remove drive gear (7) from shaft.
- (7) Remove driven gear (6) from shaft.
- (8) Force driven gear shaft (10) from oil pump.

WARNING

When relief valve is disassembled, removing cotter pin allows springs to expand with considerable force. Always keep valve facing downward and release slowly to avoid injury.

- (9) With valve facing downward, remove cotter pin (12), flat washer (13), spring set (14) and valve (15).
 - (10) Remove blind plug (11).
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:

NOTE

For the next three steps, refer to the measurements taken during disassembly.

- (1) If clearance between end of gears (6) and (7) and cover (4) exceeds figure specified in table 6-1, both gears (6) and (7) must be replaced.
- (2) If clearance between gear teeth tips and case exceeds figure specified in table 6-1, both gears (6) and (7) must be replaced.

- (3) If pump gear backlash exceeds figure specified in table 6-1, both gears (6) and (7) must be replaced.

CAUTION

If any part is replaced due to chipped teeth, replace mating part as it may have invisible fractures.

- (4) Inspect interior of pump case, surface of cover (4) and gears (6) and (7). If damaged, they must be replaced.
 - (5) Measure diameters of shafts (9) and (10). Compare measurements to figures specified in table 6-1. If wear exceeds these figures, shafts (9) and (10) must be replaced.
 - (6) Measure clearances between drive shaft (9) and its bore in pump body. If clearance exceeds figure specified in table 6-1, replace drive shaft (9) or body.
- d. Repair and replacement. Replace all worn or damaged parts.
- e. Assembly. Assemble oil pump as follows:
- (1) Coat all friction surfaces with engine oil.
 - (2) Install valve (15), spring set (14), flat washer (13) and cotter pin (12).
 - (3) Install blind plug (11).
 - (4) Install driven gear shaft (10).
 - (5) Install both gears (6) and (7) with beveled sides toward pump body.
 - (6) Recheck clearances.
 - (7) Turn drive shaft (9) by hand to check for smooth rotation.
 - (8) Install strainer (2) using screw and washer (3). Tighten to torque specified in table 6-2.
 - (9) Install cover (4) using four screws and washers (5). Tighten to torque specified in table 6-2.
- f. Installation. Install oil pump as follows:
- (1) Position oil pump and oil pump gasket (16) on engine. Install using screws and washers (1) tightened to torque specified in table 6-2.
 - (2) Position spindle assembly (17), support gasket (20) and spindle support (18) on engine. Install using screws and washers (19).

5-5.1.27 *Piston, Connecting Rod and Crankshaft Group.* Refer to figure 5-56, and perform the following steps to overhaul the piston, connecting rod and crankshaft group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove and disassemble piston, connecting rod and crankshaft group as follows:

- (1) Refer to paragraph 5-5.1.21 and remove cylinder head.
- (2) Remove crankshaft nut (8).
- (3) Remove timing gear case.
- (4) Turn engine on side.

NOTE

Mark bearings for reinstallation with proper components. Do not exchange upper and lower shell metals.

- (5) Measure end play at large end of each connecting rod. Record for future reference.
- (6) From bottom of engine, remove connecting rod hex nuts (4), lower connecting rod caps and lower bearings (7).
- (7) Remove carbon from top of pistons and ridge from top of cylinder bores prior to piston removal.
- (8) Remove pistons, connecting rods, bushings (6), connecting rod capscrews (5) and upper bearings (7).
- (9) Remove main bearing cap bolts, main bearing caps lower bearings (10) and lower thrust washers (12).

NOTE

Upper bearings and upper thrust washers may be removed when crankshaft is removed according to paragraph 5-5.1.24.

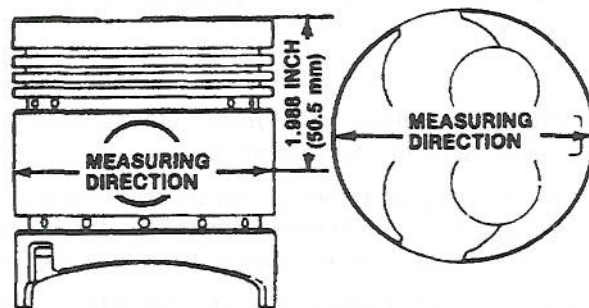
- (10) Remove upper bearings (10) and upper thrust washers (11).
- (11) Remove crankshaft pulley and flywheel assembly according to the procedures given in paragraph 5-5.1.24.
- (12) Remove woodruff key (13) and crankshaft gear (14).
- (13) Measure end play at large end of each connecting rod. Record for future reference.
- (14) Measure crankshaft end play. Record measurement for future reference.
- (15) Remove crankshaft and bushing (9).

- (16) Remove ring sets (3) from pistons.
- (17) Remove retaining rings (1) and piston pins (2).

NOTE

Because piston pin is fitted tightly into piston at ambient temperatures, it may be necessary to heat piston to remove piston pin.

- (18) Separate connecting rod and piston.
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:
 - (1) Check periphery of piston for chipping and check ring grooves for wear. If parts are chipped or worn, they must be replaced.
 - (2) Measure piston diameter as shown in figure 5-57 and calculate clearance with cylinder liner. Measurement location is 1.988 inches down from piston top, perpendicular to piston pin hole.
 - (3) Install ring sets (3) on pistons and measure clearance at five points around rings (3). See figure 5-58. If clearances exceed figures prescribed by table 6-1, install new rings (3) and recheck clearances. If new rings (3) still exceed figures given in table 6-1, pistons must be replaced.
 - (4) Insert ring (3) in cylinder and push down with piston to make sure ring (3) is squarely in cylinder bore. See figure 5-59. In standard size cylinder, gap should not exceed figure specified by table 6-1. If gap exceeds this figure, ring (3) must be replaced.



CJ-50111

Figure 5-56. Piston Measurement

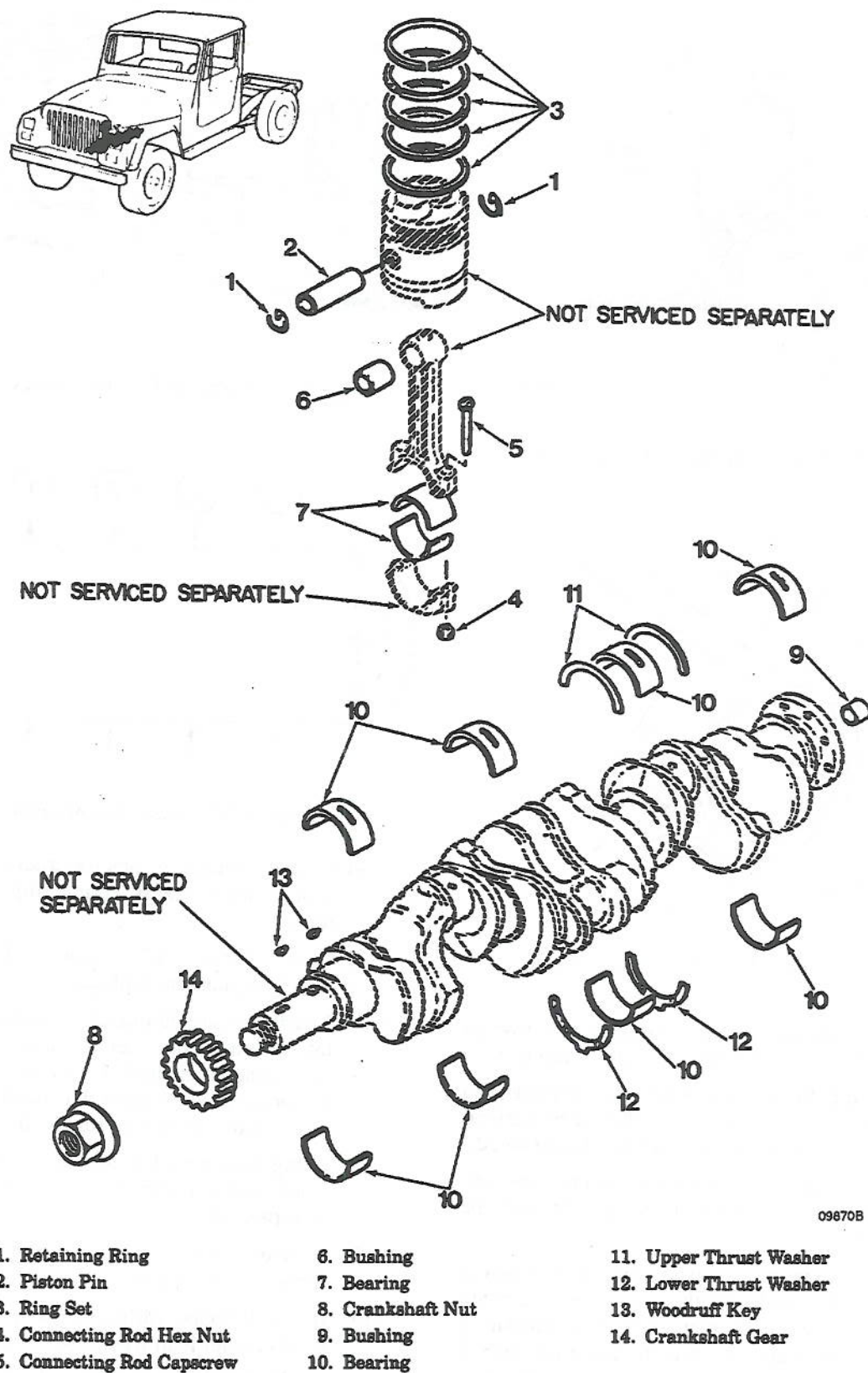
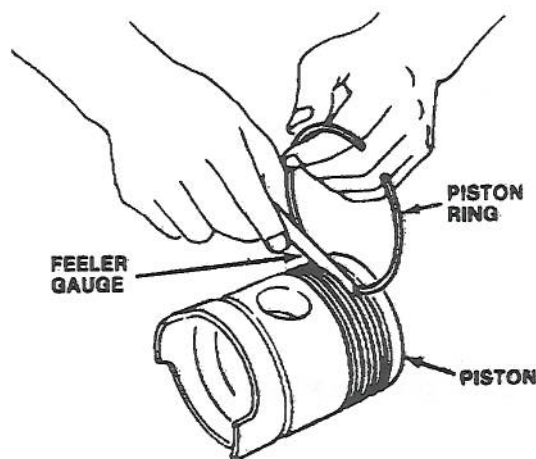


Figure 5-57. Piston, Connecting Rod and Crankshaft Group



CJ-50113

Figure 5-58. Ring Clearance Measurement

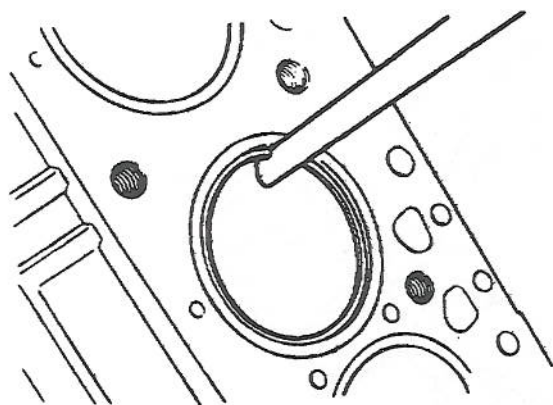


Figure 5-59. Ring End Gap Measurement

- (5) Measure piston pin bore diameter as shown in figure 5-60, and record for future reference.
- (6) If the end play of the connecting rod measured during removal exceeds the figure prescribed in table 6-1, connecting rod must be replaced.
- (7) Check piston pin (2) for severe wear or scratches. If worn or scratched, piston pin (2) must be replaced.
- (8) Measure diameter of piston pin (2) as shown in figure 5-61, and calculate clearance between piston pin (2) and piston pin bore (as measured earlier). If clearance exceeds figure prescribed in table 6-1, piston pin (2) and/or piston must be replaced.

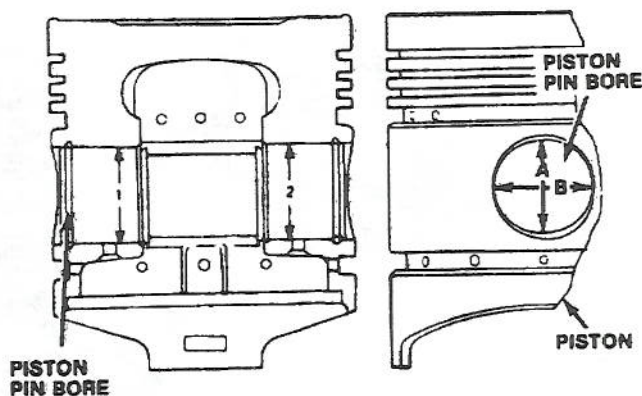


Figure 5-60. Piston Pin Bore Measurement

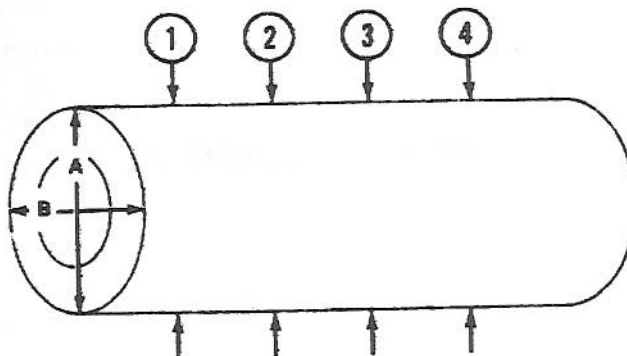


Figure 5-61. Piston Pin Measurement

- (9) Check connecting rods for cracks or scoring. If scratched or scored, connecting rods must be replaced.
- (10) Check bearings (10). If worn or damaged, bearings (10) must be replaced.
- (11) Measure inside diameter of bushing (6). Calculate clearance between bushing (6) and pin (2) (as measured earlier). If clearance exceeds figure prescribed by table 6-1, bushing (6) and/or piston pin (2) must be replaced.
- (12) Using flaw detector, inspect crankshaft (1) for cracks and scratches. If cracked, crankshaft must be replaced.
- (13) Measure main journals at two locations, as shown in figure 5-62.
- (14) If out-of-round (difference between measurements A and B in figure 5-62) or taper exceeds figure prescribed by table 6-1, journal will have to be reground to a standard bearing undersize.

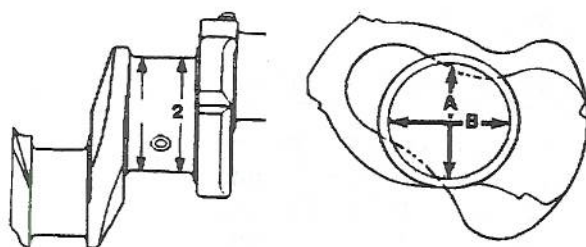


Figure 5-62. Main Bearing Journal Measurement

- (15) Measure clearance between bearing and journal. If measurement exceeds figure prescribed by table 6-1, journal must be reground.
 - (16) Measure connecting rod diameter at two locations, as shown in figure 5-63.
 - (17) If circularity (difference between measurements A and B in figure 5-63) exceeds figure prescribed by table 6-1, connecting rod journal must be reground to a standard bearing undersize.
 - (18) Measure clearance between connecting rod journal and bearings. If measurement exceeds figure specified by table 6-1, journal must be reground.
 - (19) Support crankshaft (1) horizontally and measure bend as shown in figure 5-64. One-half of indicated deflection is crankshaft bend.
 - (20) If bend exceeds figure prescribed by table 6-1, crankshaft must be straightened to bring bend to within figure prescribed by table 6-1.
- c. Repair and replacement. Replace all worn or damaged parts. In addition, perform the following steps:

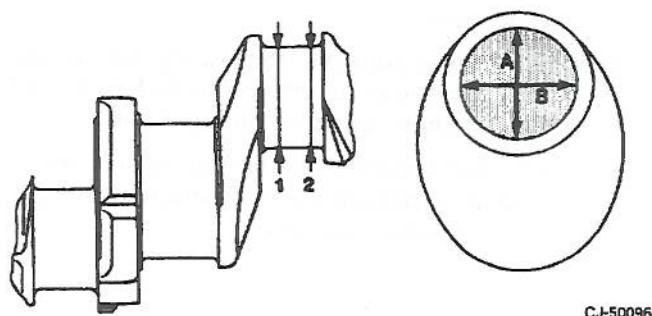
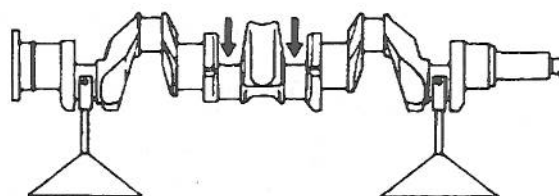


Figure 5-63. Connecting Rod Journal Measurement



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Figure 5-64. Crankshaft Bend Measurement

NOTE

During overhaul always replace piston ring set.

- (1) If crankshaft is scratched, grind to remove scratches, if there is sufficient metal to reground.
- (2) If it is necessary to reground main bearing journals, grind to obtain a journal-to-bearing clearance between figures prescribed by table 6-1. Refer to table 5-6.
- (3) If it is necessary to reground connecting rod journals, grind to obtain a journal-to-bearing clearance between figures prescribed by table 6-1. Refer to table 5-6.

NOTE

In grinding main journals and connecting rod journals, make sure dimension R in figure 5-65 is as prescribed by table 6-1. At the same time, make sure that the surface width does not increase.

- (4) If crankshaft end play recorded during disassembly was more than figure prescribed by table 6-1, install thrust washers to bring end play below figure prescribed by table 6-1. Refer to table 5-7 for thrust washer sizes.

R FOR MAIN JOURNAL: 0.118 INCH (3.0 mm)
R FOR CONNECTING ROD JOURNAL 0.138 INCH (3.5 mm)

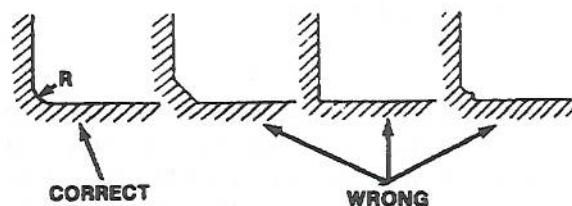


Figure 5-65. Proper Radius Dimension

Table 5-6. Bearing and Journal Regrind Chart

Main Bearing Undersize	Main Bearing Journal Reground To
0.25 mm (0.0098 in.)	2.7818-2.7823 in. (70.657-70.670 mm)
0.50 mm (0.0197 in.)	2.7719-2.7724 in. (70.407-70.420 mm)
0.75 mm (0.0295 in.)	2.7621-2.7626 in. (70.157-70.170 mm)
1.00 mm (0.0394 in.)	2.7522-2.7528 in. (69.907-60.920 mm)
Con. Rod Bearing Undersize	Con. Rod Journal Reground To
0.25 mm (0.0098 in.)	2.0733-2.0739 in. (52.663-52.676 mm)
0.50 mm (0.0197 in.)	2.0634-2.0640 in. (52.413-52.426 mm)
0.75 mm (0.0295 in.)	2.0537-2.0542 in. (52.163-52.176 mm)
1.00 mm (0.0394 in.)	2.0438-2.0433 in. (51.913-51.926 mm)

Table 5-7. Crankshaft Thrust Washer Chart

Type	Inch	mm
A	0.092	2.325
B	0.093	2.350
C	0.094	2.375
0.20 mm Oversize	0.099	2.525
0.40 mm Oversize	0.107	2.725

d. Assembly and installation. Assemble and install piston, connecting rod and crankshaft group as follows:

- (1) Install crankshaft and bushing (9).
- (2) Assemble matching bearings (10), thrust washers (11) and (12) and connecting rods and caps on crankshaft. Tighten bearing cap bolts to torque specified in table 6-2.
- (3) Measure inside diameter of bearings (10), and calculate clearance between bearings (10) and connecting rod journals. If clearance exceeds figure specified by table 6-1, bearings (10) must be replaced as a set.

NOTE

The removed bearings must be measured to determine the correct size for replacement. If the specified clearances cannot be attained using replacement bearings, the crankshaft journals must be ground undersize according to procedures given in paragraph 5-5.1.24. If journals are already at maximum underside, the crankshaft must be replaced.

- (4) Insert bushings (6) into connecting rods.
- (5) Heat pistons in hot oil bath to 140°F.
- (6) Insert piston pins (2) through pistons and connecting rods.

NOTE

Make certain that identifying numbers on pistons and connecting rods are on the same side of the assembly.

- (7) Install retaining rings (1) in piston pins (2).
- (8) Install ring sets (3) on pistons using markings as shown in figure 5-66.

NOTE

Install top ring (3) so end gap is in direct line with piston pin. Install remaining rings (3) so gaps are 180° to each other.

- (9) Insert connecting rod capscrews (5) into connecting rods.
- (10) Lubricate pistons and ring sets (3). Using a ring compressor tool, insert pistons and connecting rods into bore, as shown in figure 5-67.
- (11) Slip short lengths of rubber tubing over ends of connecting rod capscrews (5) and guide rod ends over crankshaft journals.

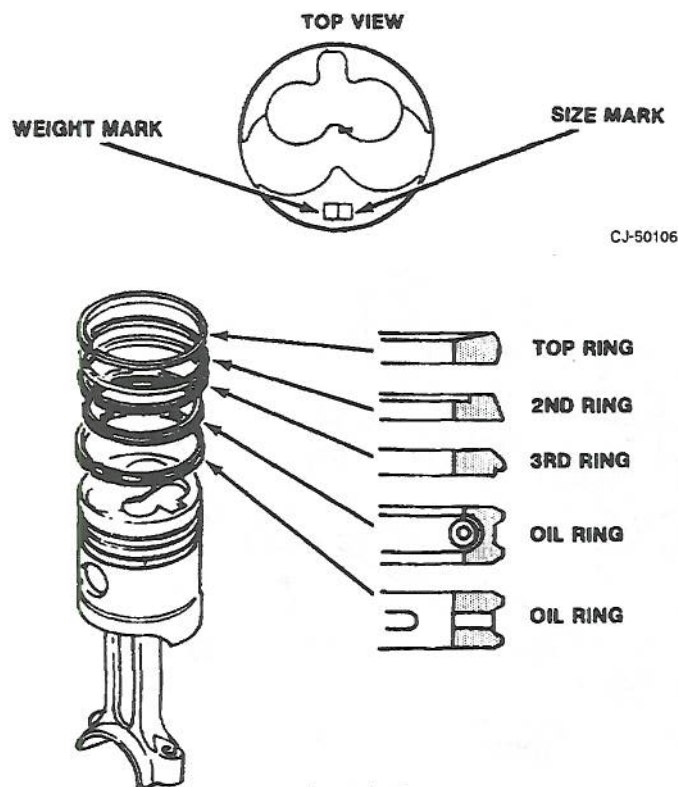


Figure 5-66. Piston and Ring Markings

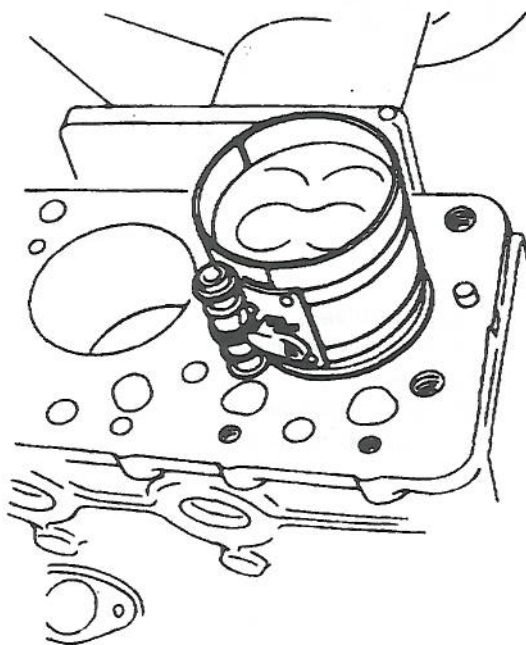


Figure 5-67. Piston and Connecting Rod Installation

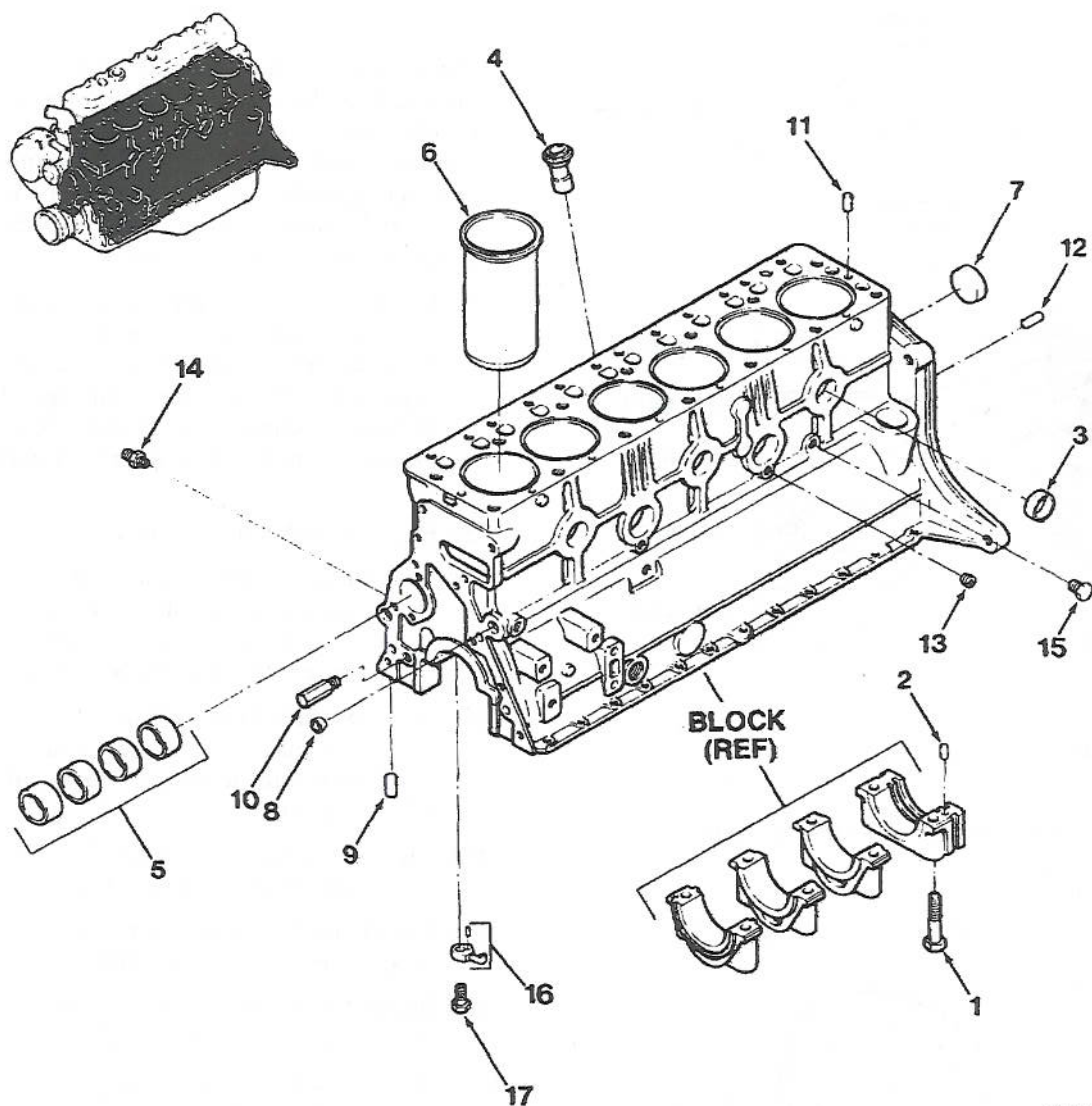
NOTE

Check number stamped onto side of connecting rod to make sure pistons are in proper cylinders. Numbered side must face exhaust manifold side of block. Casting numbers on connecting rods must face front of block on numbers 1, 3 and 5 cylinders and must face rear on numbers 2, 4 and 6 cylinders.

- (12) Match numbers on connecting rods and connecting rod caps. Coat bearings (7) with engine oil. Remove rubber sleeves from connecting rod capscrews (5) and install bearings (7) and connecting rod caps. Install connecting rod hex nuts (4) and tighten to torque prescribed in table 6-2.
- (13) Recheck rod side clearance.
- (14) Position each piston dead center and measure top clearance at front and rear of piston. If clearance is not between figures specified by table 6-1, disassemble each piston and check all parts.
- (15) Insert woodruff key (13) into key slot on crankshaft and install crankshaft gear (14). Rotate crankshaft until marks on crankshaft and camshaft coincide.
- (16) Check backlash. If backlash is not between figures prescribed by table 6-1, adjust backlash.
- (17) Install crankshaft pulley assembly according to procedures given in paragraph 5-5.1.24.
- (18) Install timing gear case according to procedure given in paragraph 5-5.1.17.
- (19) Install crankshaft nut (8) and tighten it to torque prescribed by table 6-2.
- (20) Install cylinder head according to procedure given in paragraph 5-5.1.21.

5-5.1.28 Engine Block Group. Refer to figure 5-68, and perform the following steps to overhaul the engine block group.

- a. Removal. Disassembly of the engine block group must be preceded by removing the following assemblies:
 - (1) Refer to paragraph 5-5.1.21 and remove cylinder head.
 - (2) Refer to paragraph 5-5.1.7 and remove starter motor.



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|---------------------|-------------------|-------------------------|
| 1. Capscrews | 7. Welch Plug | 13. Screw Plugs |
| 2. Straight Pin | 8. Welch Plug | 14. Straight Connector |
| 3. Welch Plugs | 9. Blind Plug | 15. Plug |
| 4. Oil Pump Bushing | 10. Oil Jet | 16. Oil Jet Assemblies |
| 5. Cam Bushing Set | 11. Straight Pins | 17. Capscrew Assemblies |
| 6. Cylinder Lines | 12. Dowels | |

Figure 5-68. Engine Block Group

- | | |
|---|---|
| (3) Refer to paragraph 5-5.1.8 and remove alternator and vacuum pump. | (5) Refer to paragraph 5-5.1.14 and remove fuel pump and fuel filter. |
| (4) Refer to paragraph 5-5.1.11 and remove water pump and fan. | (6) Refer to paragraph 5-5.1.13 and remove fuel lines. |

- (7) Refer to paragraph 5-5.1.16 and remove oil cooler and filter.
 - (8) Refer to paragraph 5-5.1.17 and remove engine front cover.
 - (9) Refer to paragraph 5-5.1.18 and remove governor assembly installation.
 - (10) Refer to paragraph 5-5.1.20 and remove injection pump assembly.
 - (11) Refer to paragraph 5-5.1.22 and remove camshaft and valve train.
 - (12) Refer to paragraph 5-5.1.23 and remove diesel preheating group.
 - (13) Refer to paragraph 5-5.1.24 and remove crankshaft and flywheel.
 - (14) Refer to paragraph 5-5.1.25 and remove engine oil pan.
 - (15) Refer to paragraph 5-5.1.26 and remove oil pump.
 - (16) Refer to paragraph 5-5.1.27 and remove pistons, rods, crank and main bearings.
 - (17) Refer to paragraph 5-5.2 and remove transmission from engine.
- b. Disassembly. Disassemble the engine block group as follows:

NOTE

Do not remove the cylinder lines unless inspection of them indicates they need repair or replacement.

- (1) Use puller tool #99600Z7000 to remove cylinder lines (6) from cylinder block.
- (2) Remove bearing cap capscrews (1) and straight pin (2) with bearing caps.

NOTE

Removal of cam bushings is not required unless they do not meet measurement limits specified in paragraph c, Cleaning and Inspection. The welch plug located in the rear of the block assembly will be removed by using the rear cam bushing.

- (3) Remove cam bushing set (5), if required, by driving out bushings, one at a time, from front of cylinder block. Knock out welch plug (7) with rear bushing.

NOTE

Do not remove welch plugs from sides of engine block unless required for cleaning entire engine block.

- (4) Remove welch plugs (3) from sides of block assembly and welch plug (8) from front of cylinder block.
 - (5) Remove oil pump bushing (4).
 - (6) Remove capscrew assemblies (17) and oil jet assemblies (16) from underside of cylinder block.
 - (7) Remove blind plug (9) from underside of cylinder block.
 - (8) Remove oil jet (10) from front of cylinder block.
 - (9) Remove straight pins (11) and cylinder dowels (12) from cylinder block.
 - (10) Remove screw plugs (3), plug (16) and straight connector (14) from cylinder block.
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the steps listed below:
- (1) Clean all surfaces and oil passages thoroughly.
 - (2) Inspect engine block for scratches and cracks.
 - (3) Check top of engine block for warp. If warp exceeds the limit specified in table 6-1, the top surface must be repaired by grinding.
 - (4) Inspect cylinder liners (6) for chipping. If chipping is present, cylinder liners (6) must be replaced.
 - (5) Measure bores of cylinder liners (6), as shown in figure 5-69, in direction A and B. Any liner that is worn beyond the limits specified in table 6-1, or with a vertical variation or circularity greater than that specified in the table 6-1, must be replaced.
 - (6) Measure protrusion of cylinder liner flange as shown in figure 5-70, and compare to values in table 6-1 for minimum, maximum and variation among cylinders. Any liner that is beyond the limits must be replaced.

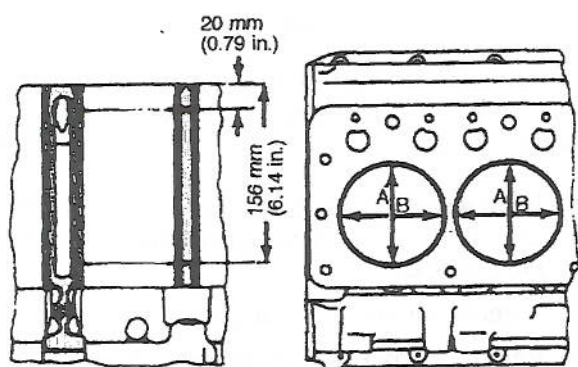


Figure 5-69. Cylinder Liner Measurement

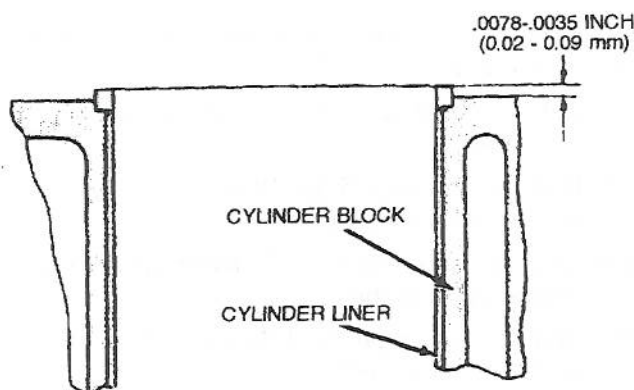


Figure 5-70. Cylinder Liner Protrusion Measurement

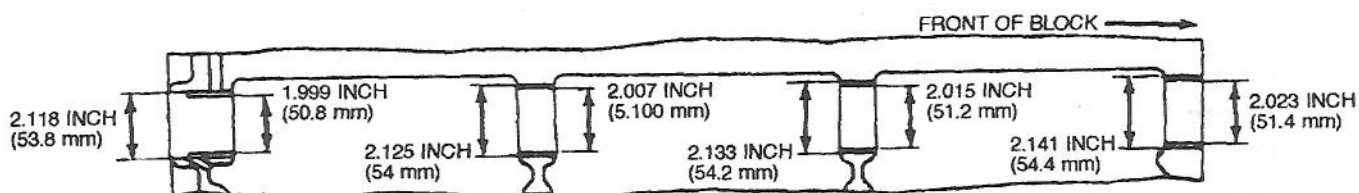


Figure 5-71. Camshaft Bushing Dimensions

NOTE

Diameters will vary from front to rear with the largest diameter on the timing gear side and the smallest toward the rear.

- (7) Measure inside dimensions of cam bushing set (5) and the respective camshaft journal diameters as shown in figure 5-71. If clearance is greater than the value in table 6-1, replace the bushing.

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi and wearing of goggles is required.

- (8) After washing and inspecting the cylinder block, use compressed air to blow away any traces of dirt from surfaces that contact cylinder head, bolt holes, water passages, etc.
- d. Repair and replacement. Replace all worn or damaged parts and make the following repairs as required.
 - (1) Replace cylinder block if there is severe damage from cracks or scratches.

CAUTION

Do not grind top surface more than specified in table 6-1.

- (2) Repair excessive warpage in top of cylinder block by regrinding top surface.
- (3) After grinding, check that distance from top surface of block assembly to crankshaft centerline is no lower than minimum wear limit specified in table 6-1.
- (4) Replace any chipped cylinder liners (15) or any cylinder liners that are found to be out of limits when measured during inspection.
- (5) Replace any camshaft bushing (5) that is out of tolerance when measured during inspection.
- e. Assembly. Assemble the engine block group components as follows:

NOTE

Apply engine oil to sliding surfaces of each engine part prior to assembly.

- (1) Install straight connector (14), plug (15) and screw plugs (13).
- (2) Install cylinder dowels (12) and straight pins (11).

NOTE

When installing oil jet, make sure that the oil jet opening faces the camshaft gear.

- (3) Install oil jet (10) in front of cylinder block.
- (4) Install blind plug (9) in underside of block assembly (1).
- (5) Install oil jet assemblies (16) and capscrew assemblies (17) in underside of cylinder block.
- (6) Install oil pump bushing (4).
- (7) Apply sealant to edges, and install welch plugs (3) so that lip of welch plugs (3) are toward outside of cylinder block.

NOTE

When installing bushings, align oil holes in bushings with oil holes in block. The number four camshaft bushing has two oil holes. The elongated hole routes oil pressure to the valve rocker shaft, and the other hole aligns with the main oil gallery.

- (8) Install the number 2 bushing, then the number 1 bushing of the cam bushing set (5) from the front of the cylinder block. Use tool #J99590Z7000 to drive bushings into place.
- (9) Install the number 3 and then the number 4 bushing of the cam bushing set (5) from rear of cylinder block. Use tool #J-99590Z7000 to drive bushings into place.
- (10) Apply sealant to welch plugs (7) and (8). Install welch plugs (7) and (8) in cylinder block.
- (11) Install bearing caps with bearing cap hex head capscrews (1) and straight pin (2).

NOTE

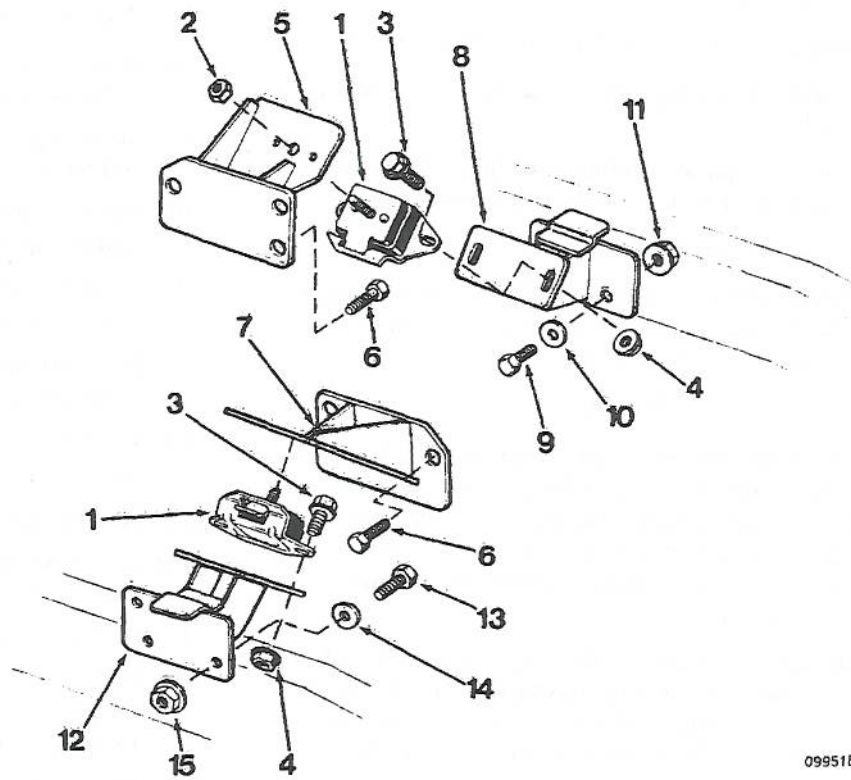
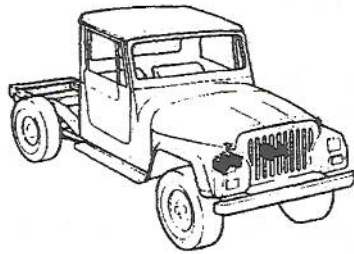
Cylinder liner protrusions must be within limits specified in table 6-1.

- (12) If cylinder liners (6) were removed, coat cylinder liner and bore with engine oil and install cylinder liners (6), using puller tool #J-99600Z7000.
- f. Installation. Install the following assemblies.
- (1) Refer to paragraph 5-5.2 and install transmission on engine.
 - (2) Refer to paragraph 5-5.1.27 and install pistons, rods, crank and main bearings.
 - (3) Refer to paragraph 5-5.1.26 and install oil pump.

- (4) Refer to paragraph 5-5.1.25 and install engine oil pan.
- (5) Refer to paragraph 5-5.1.24 and install crankshaft and flywheel.
- (6) Refer to paragraph 5-5.1.23 and install diesel preheating group.
- (7) Refer to paragraph 5-5.1.22 and install camshaft and valve train.
- (8) Refer to paragraph 5-5.1.20 and install injection pump assembly.
- (9) Refer to paragraph 5-5.1.18 and install governor assembly installation.
- (10) Refer to paragraph 5-5.1.17 and install engine front cover.
- (11) Refer to paragraph 5-5.1.16 and install oil cooler and filter.
- (12) Refer to paragraph 5-5.1.13 and install fuel lines.
- (13) Refer to paragraph 5-5.1.14 and install fuel pump and fuel filter.
- (14) Refer to paragraph 5-5.1.11 and install water pump and fan.
- (15) Refer to paragraph 5-5.1.8 and install alternator and vacuum pump.
- (16) Refer to paragraph 5-5.1.7 and remove starter motor.
- (17) Refer to paragraph 5-5.1.21 and install cylinder head.

5-5.1.29 *Front Engine Mounts Group.* Refer to figure 5-72, and perform the following steps to overhaul the front engine mounts group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove front engine mounts group as follows:
 - (1) Support front of engine wiring jack.
 - (2) Remove self-locking bolts (3) and hex nuts (4).
 - (3) Remove capscrews (9) and (13), lockwashers (10) and (14) and hex nuts (11) and (15). Remove mount assemblies (8) and (12).
 - (4) Remove locking hex nuts (2) and remove mounting pad (1).
 - (5) Remove screws and washers (6) and remove mounting brackets (5) and (7).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.



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|----------------------|---------------------|--------------------|
| 1. Mounting Pad | 6. Screw and Washer | 11. Hex Nut |
| 2. Locking Hex Nut | 7. Mounting Bracket | 12. Mount Assembly |
| 3. Self-locking Bolt | 8. Mount Assembly | 13. Capscrew |
| 4. Hex Nut | 9. Capscrew | 14. Lockwasher |
| 5. Mounting Bracket | 10. Lockwasher | 15. Hex Nut |

Figure 5-72. Front Engine Mounts Group

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install front engine mounts group as follows:

- (1) Install mounting brackets (5) and (7) using screws and washers (6).
- (2) Install mounting pads (1) on mounting brackets (5) and (7) using locking hex nuts (2).
- (3) Install mount assemblies (8) and (12) using cap screws (9) and (13), lockwashers (10) and (14) and hex nuts (11) and (15).

(4) Fasten mounting pads to mount assemblies (8) and (12) using cap screws (3) and hex nuts (4).

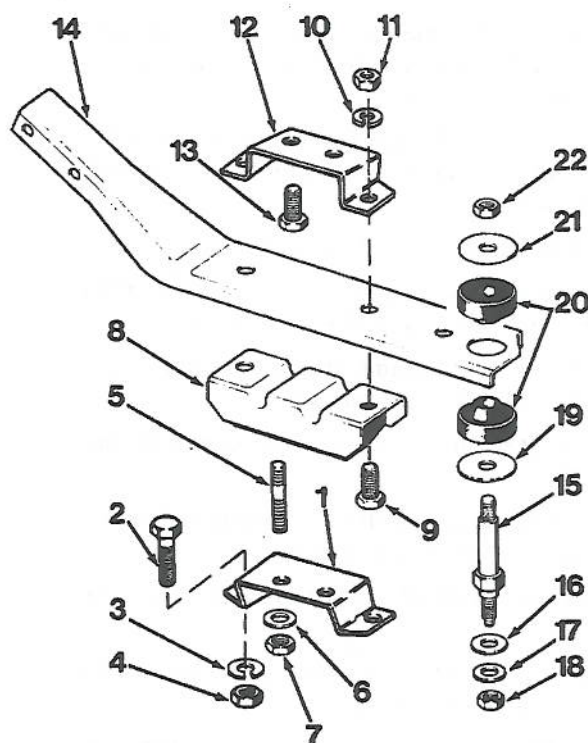
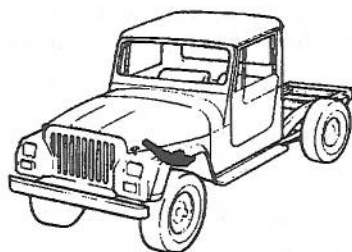
(5) Fasten mounting brackets (5) and (7) to engine using screws and washers (6).

(6) Remove jack from under engine.

5-5.1.30 *Rear Engine Mounts Group.* Refer to figure 5-73, and perform the following steps to overhaul the rear engine mounts group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove rear engine mounts as follows:

- (1) Support transmission with jack.



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|-------------------------|----------------|---------------------------|
| 1. Transmission Support | 8. Insulator | 15. Stud |
| 2. Capscrew | 9. Capscrew | 16. Washer |
| 3. Lockwasher | 10. Lockwasher | 17. Washer |
| 4. Hex Nut | 11. Hex Nut | 18. Lock Hex Nut |
| 5. Mounting Stud | 12. Bracket | 19. Flat Washer |
| 6. Flat Washer | 13. Capscrew | 20. Upper Mount Insulator |
| 7. Lock Hex Nut | 14. Bracket | 21. Washer |
| | | 22. Lock Hex Nut |

Figure 5-73. Rear Engine Mounts Group

- (2) Remove capscrews (13).
- (3) Remove lock hex nut (22), flat washer (21) and upper mount insulator (20).
- (4) Remove hex nuts (4), lockwashers (3) and capscrews (2).
- (5) Remove hardware attaching angled end of bracket (14) to frame and remove bracket (14).
- (6) Remove lower mount insulator (20) and flat washer (19).
- (7) Remove lock hex nut (18) and flat washers (17) and (16); remove stud (15).
- (8) Remove lock hex nut (7), flat washer (6) and transmission support (1).
- (9) Remove mounting stud (5) from insulator (8).
- (10) Remove hex nut (11), lockwasher (10), capscrew (9), insulator (8) and bracket (12).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install rear engine mounts group as follows:

- (1) Install insulator (8) and bracket (12) on bracket (14) using capscREW (9), lockwasher (10) and hex nut (11).
- (2) Install mounting stud (5) in insulator (8).
- (3) Install transmission support (1) on insulator (8) using flat washer (6) and lock hex nut (7).
- (4) Install stud (15) in frame using flat washers (16) and (17) and lock hex nut (18).
- (5) Install flat washer (19) and lower mount insulator (20).
- (6) Install bracket (14) on frame. Attach angled end on frame using attaching hardware.
- (7) Install capscREWS (2), lockwashers (3) and hex nuts (4).
- (8) Install upper mount insulator (20), flat washer (21) and lock hex nut (22).
- (9) Fasten bracket (12) to transmission housing using capscREWS (13).

5-5.1.31 *Fuel Tank Assembly Installation.* Refer to figure 5-74 and perform the following steps to repair the fuel tank assembly.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove fuel tank assembly as follows:

- (1) Raise back end of vehicle.

WARNING

Do not work under a raised vehicle without using safety jack stand or injury to personnel may occur.

- (2) Remove filler cap (11). Remove plug (7) from beneath vehicle and drain fuel tank.
- (3) Loosen hose clamp (2) and remove feed line (1) from elbow (6). Tape off feed line (1).
- (4) Remove elbow (6) from fuel tank (12).

- (5) Loosen hose clamp (4) and remove return line (3) from elbow (5). Tape off return line (3).

- (6) Remove elbow (5) from fuel tank (12).

- (7) Remove hex nut (18), capscREW (20), lockwasher (19) and loop clip (17).

- (8) Refer to paragraph 5-5.1.13 and remove feed line (1) and return line (3) from fuel filter.

- (9) Remove machine screws (9) and lockwashers (10) and remove sending unit and gasket (8).

- (10) Remove hex nuts (16), lockwashers (15) and flat washers (14). Remove capscREWS (13) and flat washers (14).

- (11) Remove fuel tank (12) from vehicle.

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install fuel tank assembly as follows:

- (1) Install fuel tank (12) in vehicle.

- (2) Install capscREWS (13) and flat washers (14). Install flat washers (14), lockwashers (15) and hex nuts (16).

- (3) Install sending unit and gasket (8) using capscREWS (9) and lockwashers (10).

- (4) Refer to paragraph 5-5.1.13 and connect feed line (1) and return line (3) to fuel filter.

- (5) Secure feed line (1) and return line (3) to body using loop clip (17), capscREW (20), lockwasher (19) and hex nut (18).

- (6) Install elbow (5) in fuel tank (12).

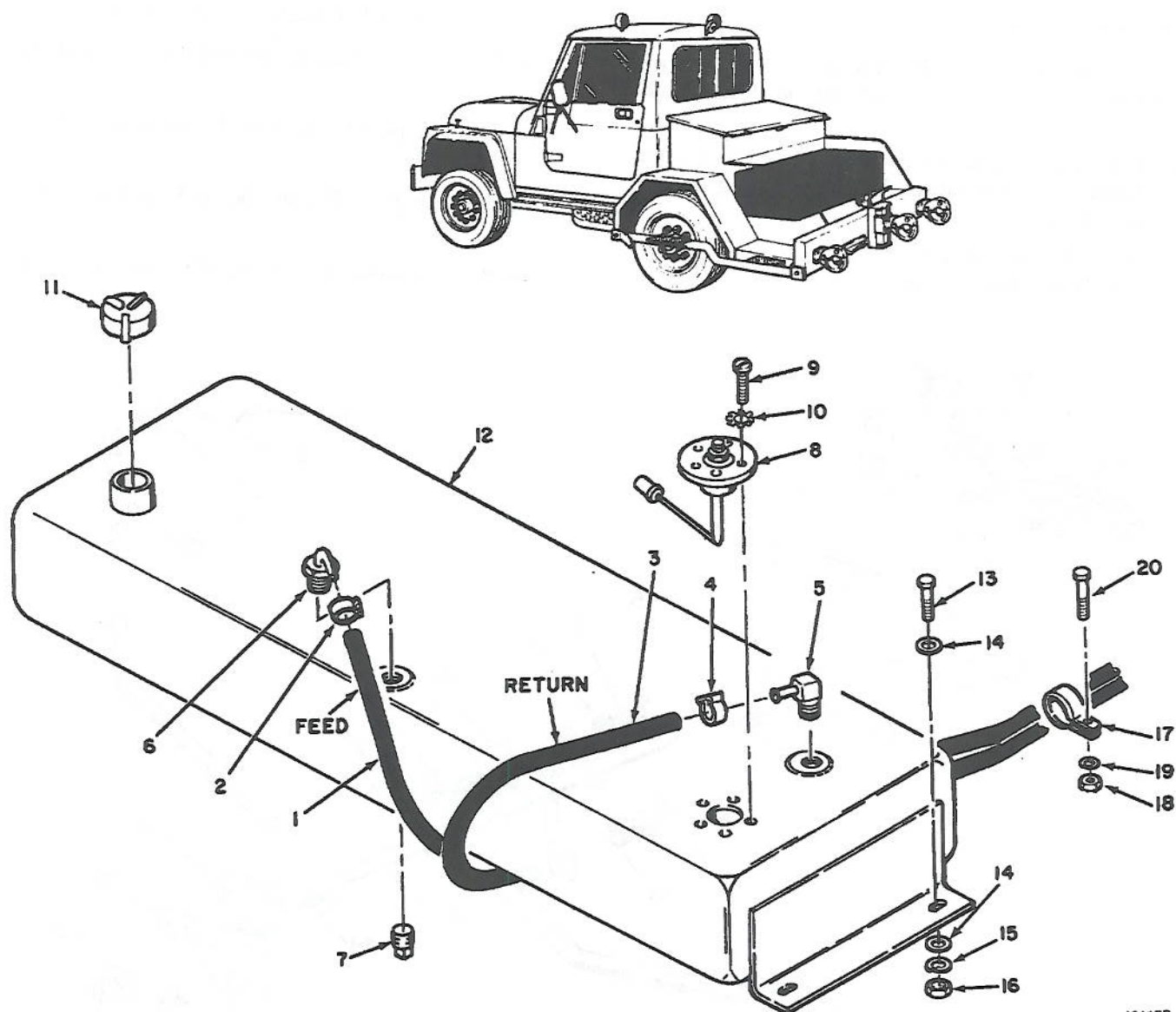
- (7) Install return line (3) on elbow (5) and tighten hose clamp (4).

- (8) Install elbow (6) in fuel tank (12).

- (9) Install feed line (1) on elbow (6) and tighten hose clamp (2).

- (10) Install plug (7) in fuel tank (12) from beneath vehicle.

- (11) Fill fuel tank (12) with fuel and install filler cap (11).



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|----------------------------|-----------------|
| 1. Feed Line | 11. Filler Cap |
| 2. Hose Clamp | 12. Fuel Tank |
| 3. Return Line | 13. Capscrew |
| 4. Hose Clamp | 14. Flat Washer |
| 5. Elbow | 15. Lockwasher |
| 6. Elbow | 16. Hex Nut |
| 7. Plug | 17. Loop Clip |
| 8. Sending Unit and Gasket | 18. Hex Nut |
| 9. Machine Screw | 19. Lockwasher |
| 10. Lockwasher | 20. Capscrew |

Figure 5-74. Fuel Tank Assembly Installation

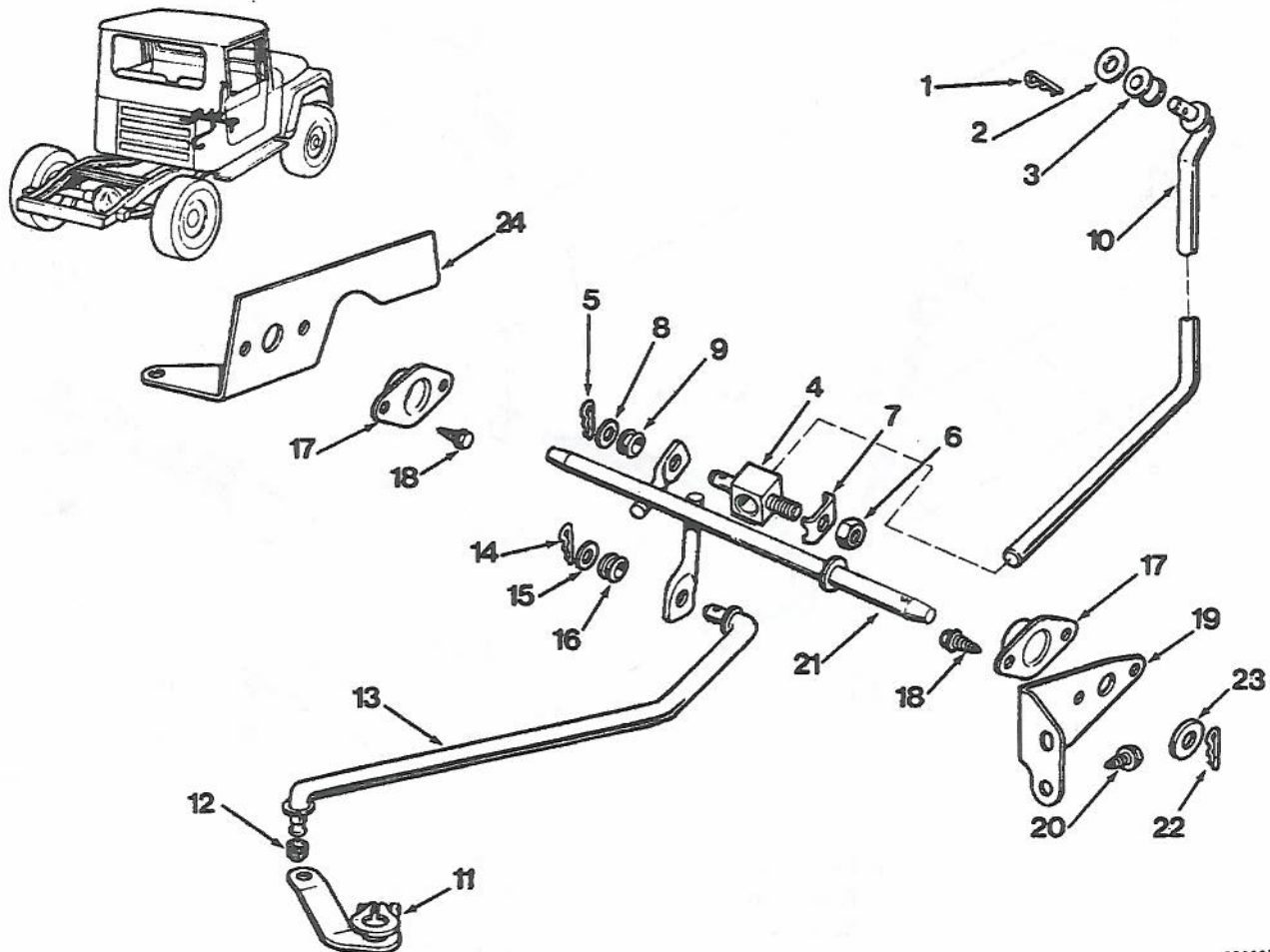
5-5.2. *Transmission.*

5-5.2.1 *Shifting Linkage.* Refer to figure 5-75, and perform the following steps to overhaul the shifting linkage.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove shifting linkage as follows:

(1) Refer to paragraph 5-5.4.2 and remove steering column upper assembly.

- (2) Remove pin (1), washer (2) and grommet (3).
- (3) Remove self-locking nut (6), lock (7) and rod (10).
- (4) Remove pin (5), washer (8), grommet (9) and block (4).
- (5) Remove pin (14), washer (15) and grommet (16).
- (6) Remove bushing (12), rod (13) and lever (11).



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|---------------------|-------------|---------------|
| 1. Pin | 9. Grommet | 17. Bearing |
| 2. Washer | 10. Rod | 18. Screw |
| 3. Grommet | 11. Lever | 19. Bracket |
| 4. Block | 12. Bushing | 20. Screw |
| 5. Pin | 13. Rod | 21. Bellcrank |
| 6. Self-Locking Nut | 14. Pin | 22. Pin |
| 7. Lock | 15. Washer | 23. Washer |
| 8. Washer | 16. Grommet | 24. Bracket |

Figure 5- 75. Shifting Linkage

- (7) Remove washer (23) and pin (22).
- (8) Remove screws (20).
- (9) Remove screws (18), bracket (19) and bearing (17).
- (10) Remove bellcrank assembly (21).
- (11) Remove screws (18), bearing (17) and bracket (24).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install shifting linkage as follows:
 - (1) Install bracket (24), bearing (17) and screws (18).
 - (2) Install bellcrank assembly (21).
 - (3) Install bearing (17), bracket (19) and screws (18).
 - (4) Install washer (23) and pin (22).
 - (5) Install screws (20).
 - (6) Install lever (11), rod (13) and bushing (12).
 - (7) Install grommet (16), washer (15) and pin (14).
 - (8) Install block (4), grommet (9), washer (8) and pin (5).
 - (9) Install rod (10), lock (7) and self-locking nut (6).
 - (10) Install grommet (3), washer (2) and pin (1).
 - (11) Refer to paragraph 5-5.4.2 and install steering column upper assembly.

5-5.2.2 *Throttle Valve Linkage Group*. Data for this paragraph will be provided in a subsequent change to this manual.

Figure 5-76. Throttle Valve Linkage Group

5-5.2.3 *Transmission Cooling Lines Group*. Refer to figure 5-77, and perform the following steps to repair the transmission cooling lines group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove transmission cooling lines group as follows:

NOTE

Transmission cooling group must be drained and flushed before removal.

- (1) Refer to paragraph 5-5.2.4 and drain transmission.
- (2) Place length of hose over cooler outlet line and secure end of hose in waste container.
- (3) Place length of hose over cooler inlet line.

WARNING

P-D-680 Type II is toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Good general ventilation is normally adequate.

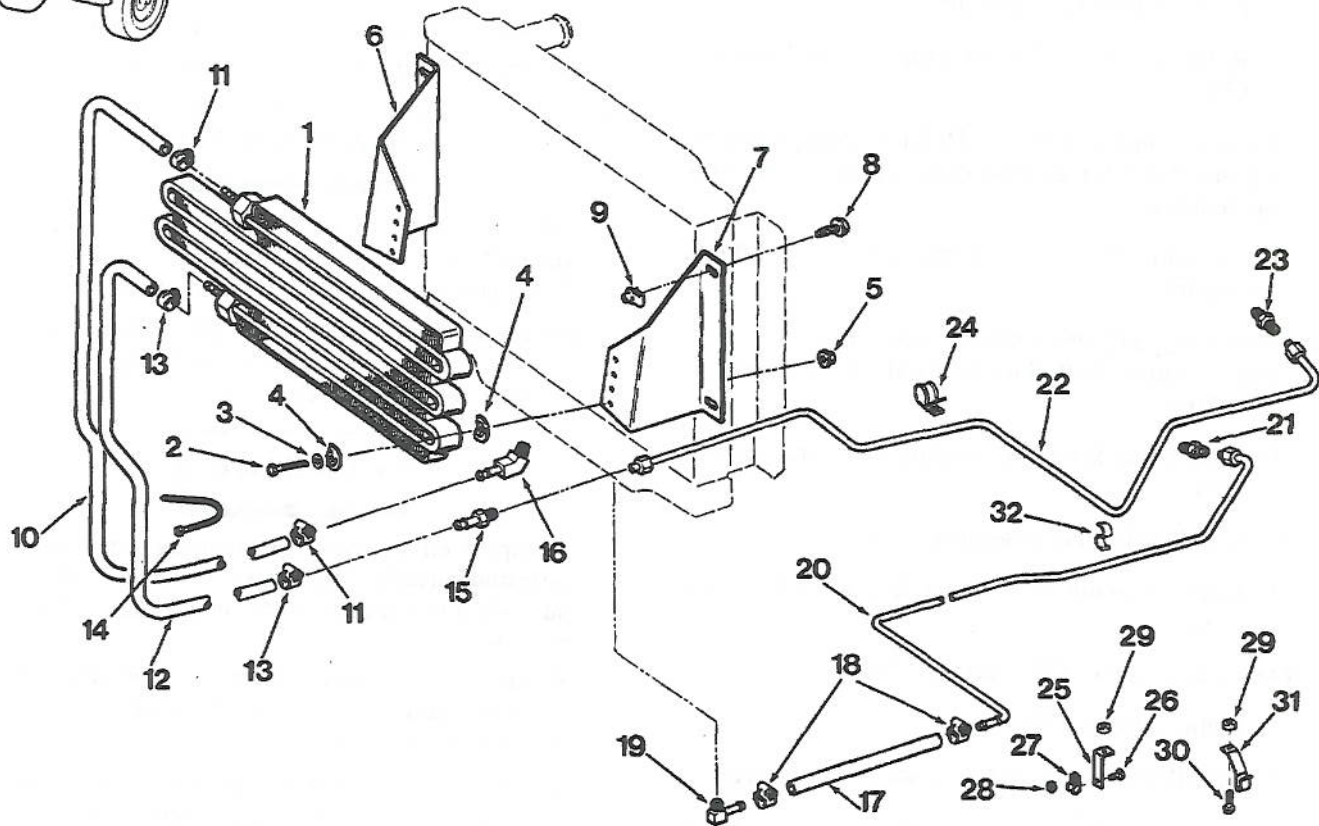
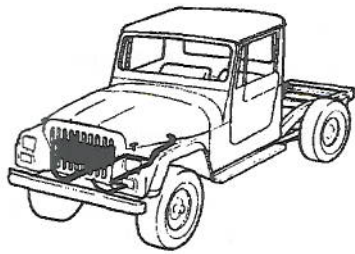
- (4) Pump approximately one pint P-D-680 Type II (7, table 5-1) into auxiliary oil cooler (1) through hose attached to inlet line.

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi and goggles must be worn.

Assure that this operation has been evaluated/reviewed and approved by the local bioenvironmental engineer.

- (5) Insert compressed air gun nozzle into hose attached to cooler inlet line. Apply short blasts of compressed air to flush dirt and solvent from cooler and lines. Repeat flushing operation until drained fluid is clear.
- (6) Pump approximately one pint of new transmission fluid into cooler and lines. Repeat flushing operation, using new transmission fluid, to remove all traces of cleaning solvent and any residual dirt.
- (7) Remove wiring strap (14).
- (8) Loosen hose clamps (11) and (13) and remove hoses (10) and (12). Remove hose clamps (11) and (13) from hoses (10) and (12).
- (9) Remove hose connector (16).
- (10) Remove capscrew (26), hex nut (28) and closed clip (27) from bracket (25).
- (11) Remove bracket (25) and spacer (29).
- (12) Remove screw with washer (30), clip (31) and spacer (29).
- (13) Disconnect connector on hose (22) from hose connector (15); remove hose (22) and connector (15).



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|-------------------------|--------------------|--------------------|
| 1. Auxiliary Oil Cooler | 12. Hose | 28. Adapter |
| 2. Capscrew | 13. Hose Clamp | 24. Closed Clip |
| 3. Flat Washer | 14. Wiring Strap | 25. Bracket |
| 4. Special Washer | 15. Hose Connector | 26. Capscrew |
| 5. Extended Nut | 16. Hose Connector | 27. Closed Clip |
| 6. Bracket | 17. Hose | 28. Hex Nut |
| 7. Bracket | 18. Hose Clamp | 29. Spacer |
| 8. Screw W/Washer | 19. Elbow | 30. Screw W/Washer |
| 9. Spring Nut | 20. Tube Assembly | 31. Clip |
| 10. Hose | 21. Adapter | 32. Clip |
| 11. Hose Clamp | 22. Tube Assembly | |

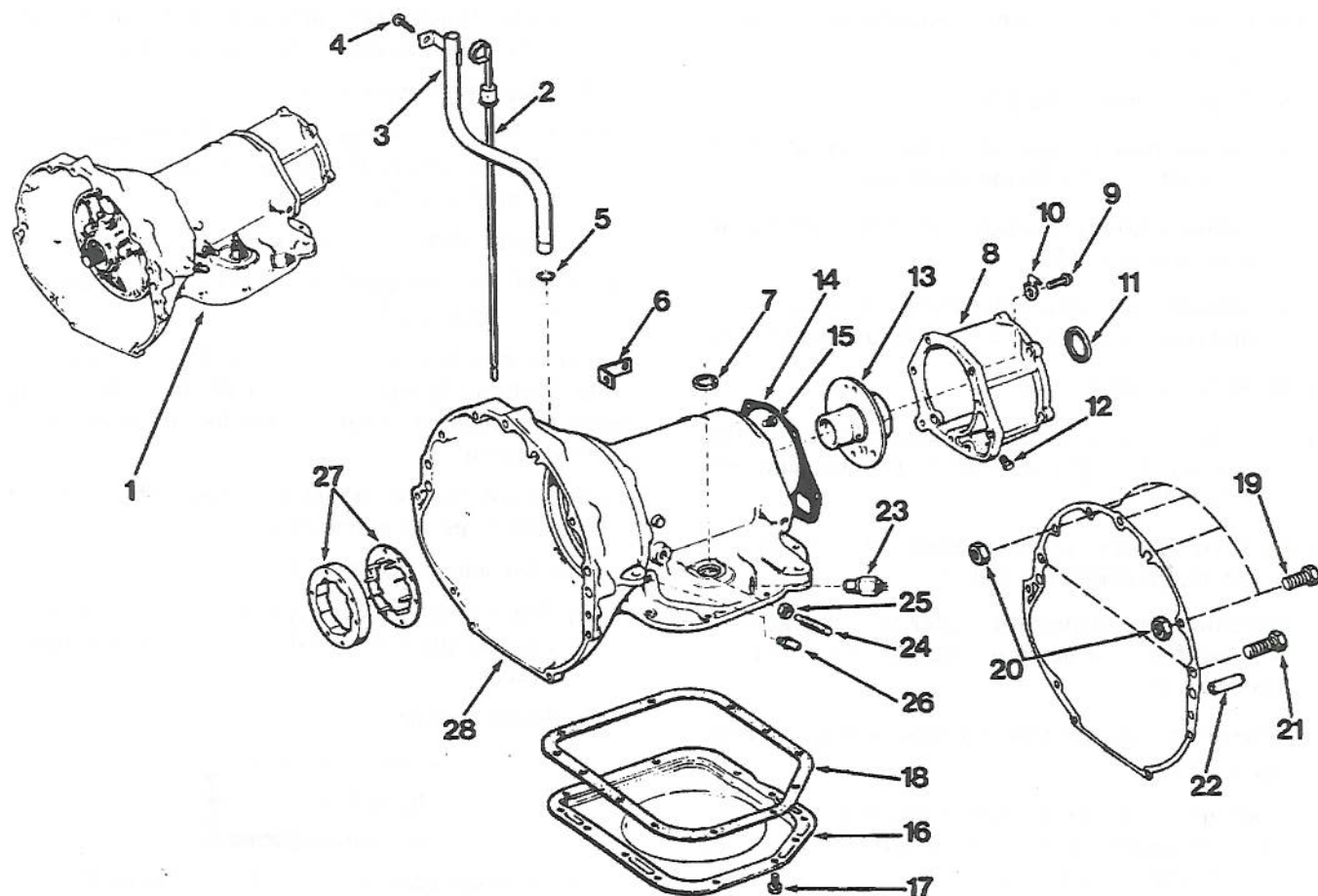
Figure 5-77. Transmission Cooling Lines Group

- (14) Remove hose (22) from adapter (23) and remove adapter (23).
 - (15) Remove closed clip (24).
 - (16) Loosen hose clamps (18) and remove hose (17) from elbow (19). Remove elbow (19).
 - (17) Remove hose (17) and hose clamps (18) from tube assembly (20).
 - (18) Remove tube assembly (20) from adapter (21) and remove clip (32) from tube assembly (20).
 - (19) Remove adapter (21).
 - (20) Remove capscrews (2), extended nut (5), flat washers (3), special washers (4) and auxiliary oil cooler (1).
 - (21) Remove screws with washers (8), spring nuts (9) and brackets (6) and (7).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
 - c. Repair and replacement. Replace all worn or damaged parts.
 - d. Assembly and installation. Assembly is accomplished during installation. Install transmission cooling lines as follows:
 - (1) Install brackets (6) and (7) using screws with washers (8) and spring nuts (9).
 - (2) Install auxiliary oil cooler (1) using capscrews (2), flat washers (3), special washers (4) and extended nut (5).
 - (3) Install fitting (21).
 - (4) Install tube assembly (20) on adapter (21).
 - (5) Install hose (17) and hose clamps (18) on tube assembly (20).
 - (6) Install elbow (19) and install free end of tube assembly on elbow. Tighten hose clamps (18).
 - (7) Install closed clip (27).
 - (8) Install adapter (23) and install hose (22) on adapter (23).
 - (9) Install connector (15) and install hose (22) on connector (15).
 - (10) Install clip (32) on tube assemblies (20) and (22).
 - (11) Install clip (31) and spacer (29) using screw with washer (30).
 - (12) Install bracket (25), spacer (29) and closed clip (27) using capscrew (26) and hex nut (28).
 - (13) Install hose connector (16).
 - (14) Install hose clamps (11) and (13) on hoses (10) and (12) and install hoses (10) and (12). Tighten hose clamps.
 - (15) Install wiring strap (14).
 - (16) Refer to paragraph 4-4.10 and refill transmission with fluid.
- 5-5.2.4 *Transmission Assembly and Case Assembly Group.* Refer to figure 5-78, and perform the following steps to overhaul the transmission assembly and case assembly group.
- a. Removal. Remove transmission assembly and case assembly group as follows:
 - (1) Disconnect fan shroud.
 - (2) Remove dipstick (2); remove screw and washer (4) and disconnect oil filler tube (3) at upper bracket.
 - (3) Raise vehicle.

WARNING

Do not work under raised vehicle without first supporting vehicle with safety jack stands or injury may occur.

- (4) Remove oil filler tube (3) and preformed packing (5).
- (5) Remove bracket (6).
- (6) Remove starter.
- (7) Mark propeller shafts and axle yokes for assembly alignment reference.
- (8) Refer to paragraph 5-5.3.1 and disconnect propeller shaft at transfer case yoke. Secure shafts to frame rails with wire.
- (9) Drain transfer case lubricant and disconnect speedometer cable at transfer case.
- (10) Disconnect gear shift.
- (11) Disconnect wires at neutral safety switch (23) and remove switch (23).
- (12) Mark torque converter drive plate and torque converter for assembly alignment reference.
- (13) Remove bolts attaching torque converter to drive plate. Rotate crankshaft and drive plate using ratchet handle and socket on crankshaft front pulley to gain access to drive plate bolts.



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|--------------------------|----------------------|----------------------------|
| 1. Transmission Assembly | 10. Clip | 19. Capscrew |
| 2. Dipstick | 11. Seal | 20. Hex Nut |
| 3. Oil Filler Tube | 12. Pipe Plug | 21. Capscrew |
| 4. Screw and Washer | 13. Shaft Support | 22. Dowel Pin |
| 5. Preformed Packing | 14. Gasket | 23. Neutral Safety Switch |
| 6. Bracket | 15. Pipe Plug | 24. Adjusting Screw |
| 7. Seal | 16. Oil Pan | 25. Hex Nut |
| 8. Transmission Adapter | 17. Screw and Washer | 26. Connector |
| 9. Screw and Washer | 18. Gasket | 27. Overrunning Clutch Kit |
| | | 28. Transmission Case |

Figure 5-78. Transmission Assembly and Case Assembly Group

- (14) Support transmission-transfer case assembly using transmission jack. Secure transmission on jack with safety chain.
- (15) Remove bolts attaching rear crossmember to transmission case (28).
- (16) Refer to paragraph 5-5.8.1 and remove rear crossmember.
- (17) Lower transmission slightly and disconnect oil cooler tube from connector (26). Remove connector (26).

- (18) Remove hex nuts (20), capscrews (19) and (21) and dowel pins (22) connecting transmission assembly (1) to engine.
- (19) Move transmission assembly (1) and torque converter rearward to clear crankshaft.
- (20) Lower transmission assembly until converter housing clears engine.
- (21) Refer to paragraph 5-5.3.2 and remove transfer case from transmission assembly (1).
- b. Disassembly. Disassemble transmission assembly and case assembly group as follows:

CAUTION

Cleanliness during disassembly and assembly is necessary to avoid a further malfunction after assembly. Before removing any of the transmission subassemblies, plug all openings and thoroughly clean the transmission exterior. Steam cleaning equipment is preferable for this purpose. During disassembly, clean all parts in a suitable solvent and dry each part using compressed air. Do not use cloth or paper towels to dry any parts after cleaning, use compressed air only.

- (1) Mount transmission in holding fixture #J-24026.
- (2) Remove screws and washers (17), oil pan (16) and gasket (18). Drain oil pan.
- (3) Loosen clamp bolts and remove throttle and gear selector levers from shafts.
- (4) Remove neutral start switch (23).
- (5) Refer to paragraph 5-5.2.6 and remove valve body.
- (6) Refer to paragraph 5-5.2.6 and remove accumulator piston and spring.
- (7) Refer to paragraph 5-5.2.7 and remove governor and support.
- (8) Refer to paragraph 5-5.2.9 and remove oil pump and reaction shaft support assembly.
- (9) Refer to paragraph 5-5.2.8 and remove kick-down band assembly and front clutch components.
- (10) Refer to paragraph 5-5.2.9 and remove input shaft assembly.
- (11) Refer to paragraph 5-5.2.8 and remove rear clutch components.
- (12) Refer to paragraph 5-5.2.9 and remove output shaft assembly and front planetary carrier assembly.
- (13) Refer to paragraph 5-5.2.8 and remove reverse band assembly; refer to paragraph 5-5.2.6 and remove drum.
- (14) Remove overrunning clutch kit (27).
- (15) Remove manual valve and seal (7).
- (16) Loosen hex nut (25) and remove adjusting screw (24) and hex nut (25).
- (17) Remove screws and washers (9) and clips (10), and remove transmission adapter (8) and gasket (14) from transmission case (28).
- (18) Remove pipe plugs (15) and (12).
- (19) Remove output shaft support (13) from adapter (8) and remove seal (11).
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- d. Repair and replacement. Replace all worn or damaged parts.
- e. Assembly. Assemble transmission assembly and case assembly group as follows:
 - (1) Install output shaft support (13) in adapter (8) and install seal (11).
 - (2) Install pipe plugs (15) and (12).
 - (3) Install transmission adapter (8) and gasket (14) on transmission case (28) and install clips (10) and screws and washers (9). Tighten screws to torque specified in table 6-2.
 - (4) Install adjusting screw (24) and hex nut (25).
 - (5) Install manual valve and seal (7).
 - (6) Install overrunning clutch kit (27).
 - (7) Refer to paragraph 5-5.2.6 and install drum; refer to paragraph 5-5.2.8 and install reverse band assembly.
 - (8) Refer to paragraph 5-5.2.9 and install output shaft assembly and front planetary carrier assembly.
 - (9) Refer to paragraph 5-5.2.8 and install rear clutch components.
 - (10) Refer to paragraph 5-5.2.9 and install input shaft assembly.
 - (11) Refer to paragraph 5-5.2.8 and install kickdown band assembly and front clutch components.

- (12) Refer to paragraph 5-5.2.9 and install oil pump and reaction shaft support assembly.
- (13) Refer to paragraph 5-5.2.7 and install governor and support.
- (14) Refer to paragraph 5-5.2.6 and install accumulator piston and spring.
- (15) Refer to paragraph 5-5.2.6 and install valve body.
- (16) Install neutral start switch (23).
- (17) Install throttle and gear selector levers on shafts and install bolts.
- (18) Install oil pan (16) and gasket (18) using screws and washers (17). Tighten screws to torque specified by table 6-2.
- (19) Remove transmission from holding fixture #J-24026.

f. Installation. Install transmission assembly and case assembly group as follows:

- (1) Refer to paragraph 5-5.3.2 and install transfer case from transmission assembly (1).
- (2) Raise transmission using jack and align converter with drive plate. Refer to assembly alignment marks.
- (3) Move transmission forward.
- (4) Connect transmission assembly (1) to engine using capscrews (19) and (21), dowel pins (22) and hex nuts (20). Tighten hex nuts to torque prescribed by table 6-2.
- (5) Install connector (26) and connect oil cooler line.
- (6) Install rear support cushion on transmission.
- (7) Raise transmission; refer to paragraph 5-5.8.1 and install rear crossmember.
- (8) Remove transmission jack.
- (9) Install speedometer cable.
- (10) Install inspection cover.
- (11) Install starter.
- (12) Connect wires to neutral safety switch.
- (13) Refer to paragraphs 5-5.2.1 and 5-5.2.2 and connect gearshift and throttle linkage.
- (14) Refer to paragraph 5-5.3.1 and install propeller shafts. Refer to alignment marks made during removal.
- (15) Install oil filler tube (3) and preformed packing (5). Install screw and washer (4). Tighten screw to torque specified by table 6-2.
- (16) Install dipstick (2).
- (17) Install bracket (6).
- (18) Fill transfer case to correct level with lubricant specified in table 4-3.
- (19) Lower vehicle.
- (20) Fill transmission to correct level with transmission fluid specified in table 4-3.
- (21) Refer to paragraph 5-5.2.1 and adjust gearshift linkage.
- (22) Road test to check transmission operation.

5-5.2.5 *Torque Converter Group*. Refer to figure 5-79, and perform the following steps to overhaul the torque converter group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove torque converter group as follows:

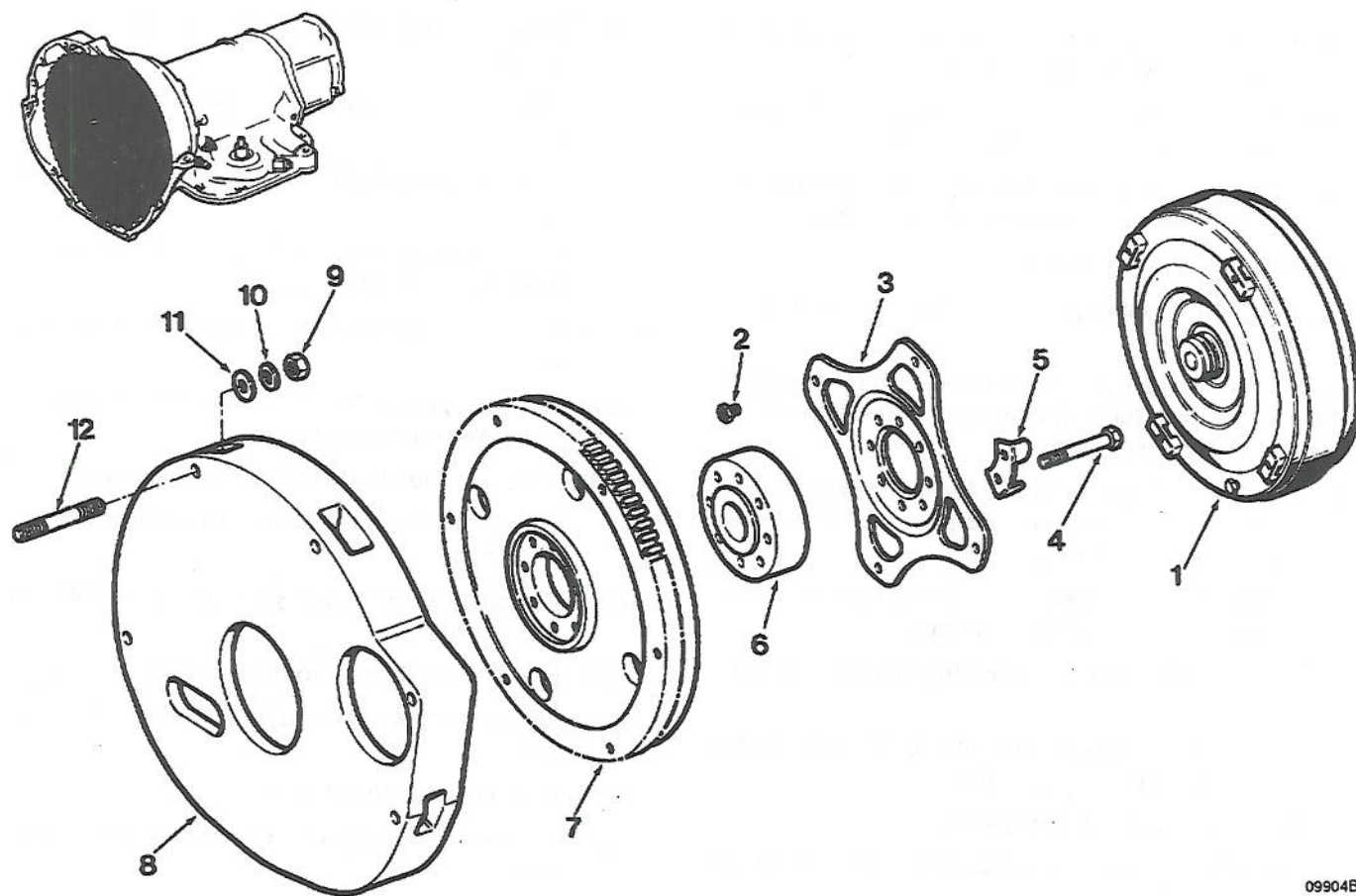
- (1) Refer to paragraph 5-5.3.1 and disconnect propeller shafts at transfer case housing.
- (2) Support transmission using transmission jack.
- (3) Refer to paragraph 5-5.2.4 and remove screws mounting transmission to crossmember.
- (4) Refer to paragraph 5-5.8.1 and remove crossmember supporting transmission.
- (5) Remove bolt attaching transmission to engine.
- (6) Remove bolts (2) and move transmission back 6 to 10 inches.
- (7) Flatten fingers of lockplates (5) and remove bolts (4) and lockplates (5).
- (8) Remove drive plate (3), adapter (6) and flywheel assembly (7).
- (9) Remove torque converter (1).
- (10) Remove hex nut (9), lockwashers (10), flat washer (11) and flywheel housing (8).
- (11) Remove mounting studs (12).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install torque converter group as follows:

- (1) Install mounting studs (12) in engine block.



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1. Torque Converter
2. Bolt
3. Drive Plate
4. Bolt
5. Lockplate
6. Adapter
7. Flywheel Assembly
8. Flywheel Housing
9. Hex Nut
10. Lockwasher
11. Flat Washer
12. Mounting Stud

Figure 5-79. Torque Converter Group

- (2) Install flywheel housing (8) using flat washer (11), lockwasher (10) and hex nut (9).
- (3) Install torque converter (1).
- (4) Install drive plate (3), adapter (6) and flywheel assembly (7).
- (5) Install bolts (4) and lockplates (5). Tighten bolts to torque specified in table 6-2.
- (6) Bend fingers of lockplates (5) flush against sides of bolt heads.
- (7) Install bolts (2). Tighten to torque specified by table 6-2.

- (8) Slide transmission against engine and install transmission-to-engine attaching bolts.
- (9) Refer to paragraph 5-5.8.1 and install cross-member supporting transmission.
- (10) Refer to paragraph 5-5.2.4 and install screws mounting transmission to crossmember.
- (11) Remove transmission jack.
- (12) Refer to paragraph 5-5.3.1 and disconnect propeller shaft.

5-5.2.6 *Servo and Valve Body Group.* Refer to figure 5-80 and perform the following steps to overhaul the servo and valve body group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove the servo and valve body as follows:

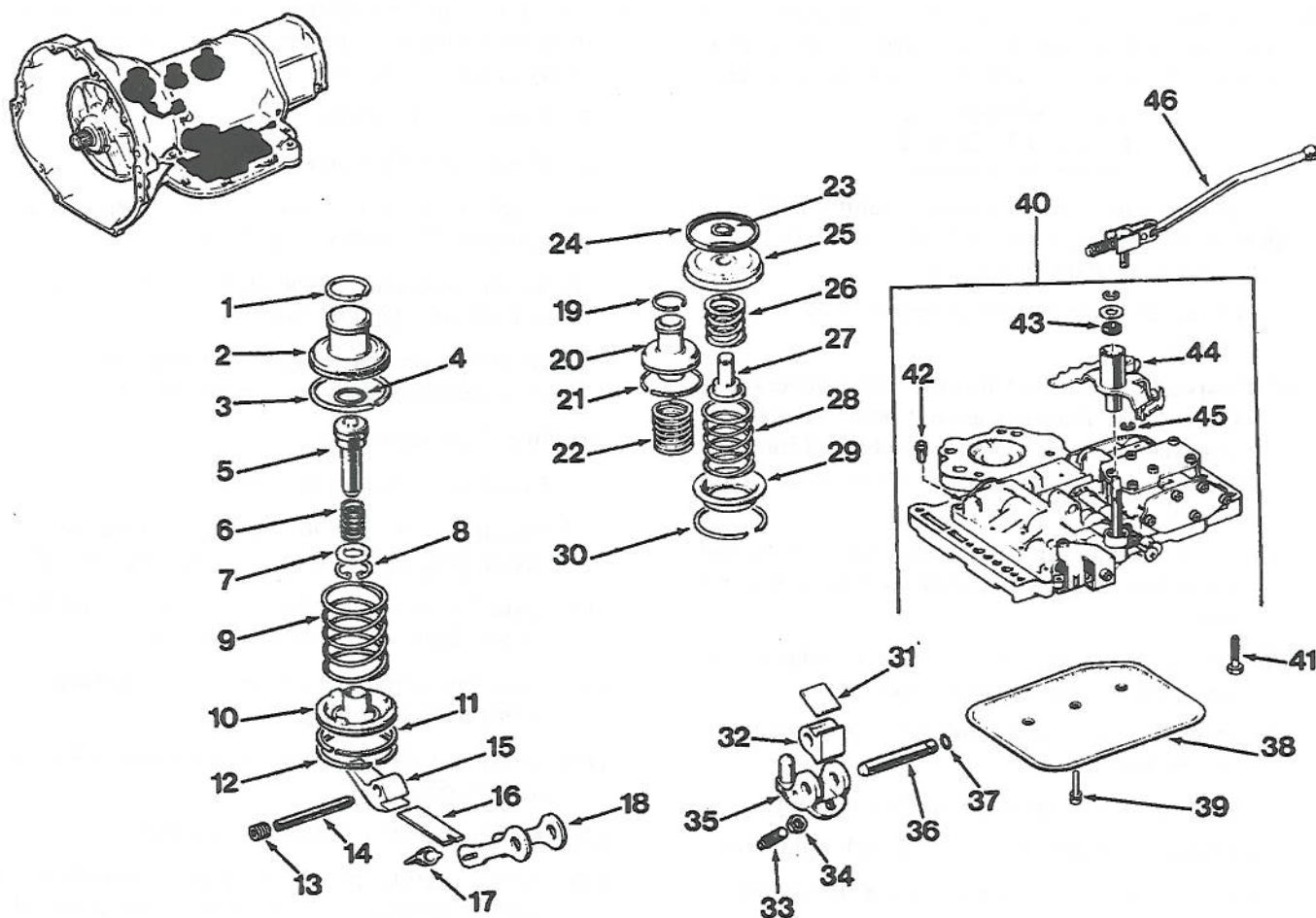
- (1) Refer to paragraph 5-5.2.4 and remove transmission assembly from vehicle.
- (2) Mount transmission assembly in holding fixture #J-24026.
- (3) Loosen clamp bolts and remove throttle and gear selector levers from shafts.
- (4) Remove neutral start switch.
- (5) Remove valve body assembly (40) attaching screws (41).
- (6) Remove valve body. Lift body assembly (40) from case and pull rod assembly (46) forward out of case at same time.

NOTE

If necessary, rotate the output shaft to allow the rod assembly to clear the sprag.

- (7) Mount valve body on support stand #J-24043.
- (8) Remove screws and washers (39) and filter assembly (38).
- (9) Remove retaining ring, washer and shaft seal (43), and remove lever assembly (44). Remove valve screen (42).
- (10) Remove retaining ring (45) and remove rod assembly (46) from lever assembly (44).
- (11) Remove lever spring (22) from accumulator piston (20) and remove accumulator piston (20). Remove seals (19) and (21) from piston (20).
- (12) Refer to paragraph 5-5.2.7 and remove governor and support.
- (13) Refer to paragraph 5-5.2.9 and remove oil pump and reaction shaft.

- (14) Refer to paragraph 5-5.2.8 and remove front clutch.
- (15) Refer to paragraph 5-5.2.9 and remove input shaft.
- (16) Refer to paragraph 5-5.2.8 and remove rear clutch.
- (17) Refer to paragraph 5-5.2.9 and remove output shaft and planetary gears.
- (18) Refer to paragraph 5-5.2.8 and remove reverse drum.
- (19) Refer to paragraphs 5-5.2.4 and 5-5.2.9 and remove overrunning clutches.
- (20) Remove plug (13), shaft (14) and pawl (15).
- (21) Remove anchor (17), strut (16) and link assembly (18).
- (22) Compress servo guide (10) until it bottoms in case bore.
- (23) Insert screwdriver into pressure port.
- (24) Slowly release servo guide (10) against screwdriver.
- (25) Remove retaining ring (12).
- (26) Compress servo guide (10) and remove screwdriver.
- (27) Slowly release and remove seal (11), servo guide (10) and piston spring (9).
- (28) Remove retaining ring (8), piston retainer (7) and piston spring (6).
- (29) Remove servo piston assembly (5).
- (30) Remove seals (3) and (4).
- (31) Remove piston (2) and seal (1).
- (32) Compress piston spring (28) and remove retaining ring (30).
- (33) Remove piston spring (28) and piston plug (27).
- (34) Remove retaining ring (23), piston (25) and cushion spring (26).
- (35) Remove seal (24) from piston (25).
- (36) Remove band adjusting screw (33) and locknut (34).
- (37) Remove preformed packing (37) from lever shaft (36). Thread 1/4 inch bolt into lever shaft (36) and remove lever shaft (36) from lever assembly (35).
- (38) Remove lever (32) and strut (31).



09969B

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|-----------------------|------------------------|-----------------------|
| 1. Seal | 17. Anchor | 33. Adjusting Screw |
| 2. Front Servo Piston | 18. Link Assembly | 34. Locknut |
| 3. Seal | 19. Seal | 35. Lever Assembly |
| 4. Seal | 20. Accumulator Piston | 36. Lever Shaft |
| 5. Piston Assembly | 21. Seal | 37. Preformed Packing |
| 6. Piston Spring | 22. Lever Spring | 38. Filter Assembly |
| 7. Piston Retainer | 23. Retaining Ring | 39. Screw and Washer |
| 8. Retaining Ring | 24. Piston Seal | 40. Body Assembly |
| 9. Piston Spring | 25. Piston | 41. Capscrew |
| 10. Servo Guide | 26. Cushion Spring | 42. Valve Screen |
| 11. Seal | 27. Piston Plug | 43. Shaft Seal |
| 12. Retaining Ring | 28. Piston Spring | 44. Lever Assembly |
| 13. Plug | 29. Piston Retainer | 45. Retaining Ring |
| 14. Shaft | 30. Retaining Ring | 46. Rod Assembly |
| 15. Pawl | 31. Strut | |
| 16. Strut | 32. Short Lever | |

Figure 5-80. Servo and Valve Body Group

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:

CAUTION

Do not use any type of caustic cleaning solution when cleaning servo and valve body group components as damage may result.

- (1) Clean regulator filter in solvent (9, table 5-1) and air dry.
 - (2) Inspect manual and throttle valve levers and shafts to see that they are not bent, worn or excessively loose. If a lever assembly exhibits any of these conditions, it must be repaired or replaced.
 - (3) Inspect all mating surfaces for burrs, nicks and scratches. Repair minor abrasions or replace part.
 - (4) Use a straightedge and inspect all mating surfaces for warpage or distortion.
 - (5) Inspect accumulator piston (27) for nicks, burrs, scores and wear.
 - (6) Be sure rings turn freely in piston grooves.
 - (7) Inspect case bore for scores or other damage.
 - (8) Inspect spring (22) for cracks or distortion.
 - (9) Check ring grooves for damage. If damaged, piston (2) must be replaced.
 - (10) Inspect piston bore for damage. If damaged, assembly must be replaced.
 - (11) Inspect piston springs (26) and (28) for distortion and inspect bore in piston (25) and seal (24) for damage. Any damaged components must be replaced.
- c. Repair and replacement. Replace all worn or damaged parts. In addition, perform the following steps:

WARNING

Avoid breathing fumes generated by soldering or unsoldering as they can cause injury. Eye protection and good general ventilation are required.

- (1) If a lever is loose on a shaft, it may be repaired by silver soldering or by replacing lever and shaft assembly.
- (2) Remove all minor abrasions and correct minor warpage and distortion with crocus cloth using light pressure.

- d. Assembly and installation. Assembly is accomplished during installation. Install servo and valve body group as follows:

- (1) Install rear band in case.
- (2) Install lever (32) and strut (31).
- (3) Install lever shaft (36) and install preformed packing (37) on lever shaft (36).
- (4) Thread adjusting screw (33) in just far enough to hold strut (31) in place.
- (5) Be sure lever assembly (35) is installed to provide clearance for rear band and drum.
- (6) Install locknut (34).
- (7) Install seal (24) on piston (25).
- (8) Install piston (25) and cushion spring (26) on piston plug (27) and install retaining ring (23).
- (9) Install piston assembly and piston spring (28) in case bore with twisting motion.
- (10) Place piston retainer (29) and retaining ring (30) over piston assembly.
- (11) Compress piston spring by hand and install retaining ring (30).
- (12) Install seals (1), (3) and (4) on piston (2).
- (13) Apply petroleum jelly to piston assembly (5) and install piston assembly in piston assembly (2).
- (14) Install piston spring (6) on piston assembly (5).
- (15) Install piston retainer (7); compress piston ring (6) and install retaining ring (8).
- (16) Install piston assembly components into case bore.
- (17) Install piston spring (9) and guide (10). Install seal (11) on servo guide (10).
- (18) Compress piston spring (9) with large C-clamp and install retaining ring (12).
- (19) Slide front band over front clutch assembly.
- (20) Install link assembly (18), strut (16) and anchor (17).
- (21) Install pawl (15), shaft (14) and plug (13).
- (22) Refer to paragraphs 5-5.2.4 and 5-5.2.9 and install overrunning clutches.
- (23) Refer to paragraph 5-5.2.8 and install reverse drum.
- (24) Refer to paragraph 5-5.2.9 and install output shaft and planetary gears.

- (25) Refer to paragraph 5-5.2.8 and install rear clutch.
- (26) Refer to paragraph 5-5.2.9 and install input shaft.
- (27) Refer to paragraph 5-5.2.8 and install front clutch.
- (28) Refer to paragraph 5-5.2.9 and install oil pump and reaction shaft.
- (29) Refer to paragraph 5-5.2.7 and install governor and support.
- (30) Install seals (19) and (21) on accumulator piston (20) and install piston (20) and spring (22) in case bore.
- (31) Insert rod assembly (46) through opening in rear of case.
- (32) Position knob of rod assembly (46) against reaction plug and sprag.
- (33) Move front end of rod assembly (46) toward centerline of transmission while exerting rearward pressure on rod assembly (46) to force it past sprag. Rotate output shaft, if necessary.

NOTE

Before installing the valve body, be sure the neutral start switch has not yet been installed.

- (34) Install valve screen (42) and lever assembly (44).
- (35) Install shaft seal (43), washer and retaining ring.
- (36) Connect rod assembly (46) using retaining ring (45).
- (37) Shift lever assembly (44) to DRIVE position.
- (38) Place body assembly (40) in its approximate position.
- (39) Align body assembly (40) in case and install capscrews (41) fingertight.
- (40) Install neutral start switch.
- (41) Shift lever assembly (44) to NEUTRAL position.
- (42) Relocate body assembly (40) if necessary to align lever assembly (44) neutral finger over neutral start switch plunger ball.
- (43) Tighten capscrews (41) to torque specified by table 6-2.
- (44) Install gearshift control lever on lever assembly (44) shaft and tighten bolt.
- (45) Check lever assembly (44) shaft for binding in case by moving lever through all detent positions.

NOTE

If binding exists, loosen capscrews and align the valve body.

- (46) Install filter assembly (38) using screws and washers (39).
- (47) Remove transmission assembly from holding fixture #J-24026. Refer to paragraph 5-5.2.4 and install transmission assembly in vehicle.

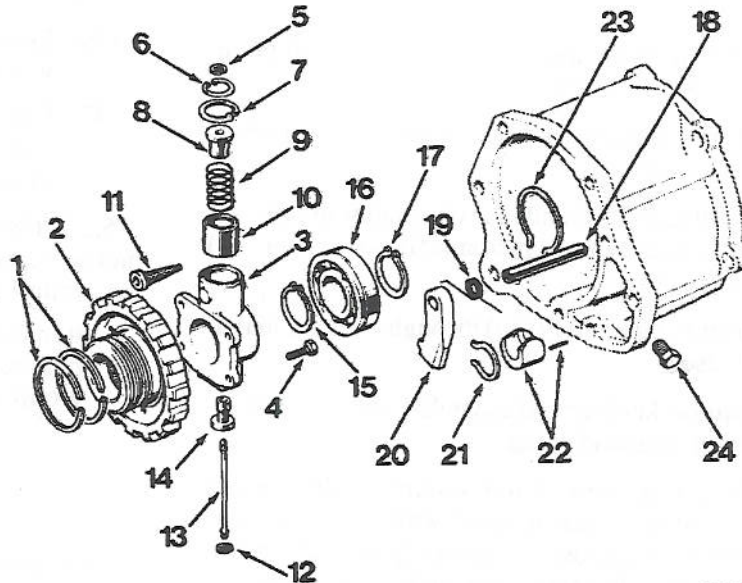
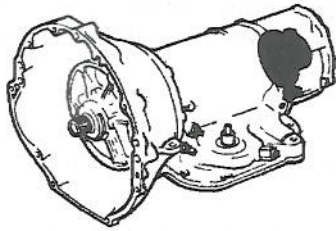
5-5.2.7 Governor Control Group. Refer to figure 5-81, and perform the following steps to overhaul the governor control group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove governor control group as follows:

WARNING

Do not work beneath a vehicle without first supporting it with safety jack stands.

- (1) Raise vehicle and support with safety jack stands.
- (2) Mark propeller shaft yokes for assembly alignment reference.
- (3) Refer to paragraph 5-5.3.1 and disconnect front-rear propeller shafts at transfer case.
- (4) Disconnect speedometer cable at transfer case.
- (5) Place support stand under transmission converter housing.
- (6) Refer to paragraph 5-5.8.1 and remove rear crossmember.
- (7) Disconnect parking brake cable at equalizer and disconnect exhaust pipe support brackets, if necessary.
- (8) Refer to paragraph 5-5.3.2 and remove bolts attaching transfer case to transmission adapter housing. Remove transfer case.
- (9) Refer to paragraph 5-5.8.1 and remove bolts attaching adapter housing to transmission. Remove adapter housing.
- (10) Rotate transmission output shaft until governor weight faces downward.
- (11) Remove retaining rings (12) and (5).
- (12) Remove valve shaft (13) and valve (14).



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|---------------------|---------------------|--------------------|
| 1. Seals | 9. Spring | 17. Retaining Ring |
| 2. Governor Support | 10. Governor Weight | 18. Sprag Shaft |
| 3. Governor Body | 11. Filter | 19. Spring |
| 4. Capscrews | 12. Retaining Ring | 20. Sprag |
| 5. Retaining Ring | 13. Valve Shaft | 21. Retaining Ring |
| 6. Retaining Ring | 14. Valve | 22. Plug Assembly |
| 7. Retaining Ring | 15. Retaining Ring | 23. Retaining Ring |
| 8. Governor Weight | 16. Reverse Drum | 24. Pipe Plug |

Figure 5-81. Governor Control Group

- (13) Rotate output shaft until governor weights (8) and (10) face outward.
- (14) Remove retaining ring attaching governor body (3) to output shaft.
- (15) Remove governor body (3) and governor support (2) from output shaft.
- (16) Remove retaining rings (6) and (7).
- (17) Remove inner weight (8), spring (9) and outer weight (10).
- (18) Lift lock tabs on governor body (3).
- (19) Remove capscrews (4) and remove governor body (3) from governor support (2).
- (20) Remove retaining rings (15), (17) and (23) and reverse drum (16).
- (21) Remove seals (1) and filter (11).
- (22) Remove sprag shaft (18) from adapter housing.
- (23) Remove sprag (20) and spring (19).
- (24) Remove retaining ring (21) and plug assembly (22).
- (25) Remove pipe plug (24).

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:

CAUTION

Do not clean governor parts with a caustic cleaning solution.

- (1) Thoroughly clean and dry all governor parts and check for free movement. Weights (8) and (10) and valve should fall freely in these bores when clean and dry.
- (2) Polish any burrs or rough spots with crocus cloth.
- (3) Inspect spring (9) for distortion.
- (4) Inspect governor support (2) for damaged ring grooves.

WARNING

P-D-680 Type II is toxic to the skin, eyes and respiratory tract. Wear skin and eye protection. Good general ventilation is usually adequate.

- (5) Clean filter (11) in P-D-680 Type II (7, table 5-1) and air dry. If damaged or defective, it must be replaced.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install governor control group as follows:
- (1) Install pipe pressure plug (24).
 - (2) Install plug assembly (22) and snap ring (21).
 - (3) Install sprag (20) and spring (19).

NOTE

The square lug on the sprag must face the park gear.

- (4) Position spring so it moves sprag away from gear.
- (5) Install sprag shaft (18).
- (6) Install seals (1) and filter (11).
- (7) Install reverse drum (16) and retaining rings (15), (17) and (23).
- (8) Install governor body (3) on governor support (2) using capscrews (4). Tighten capscrews (4) finger tight.

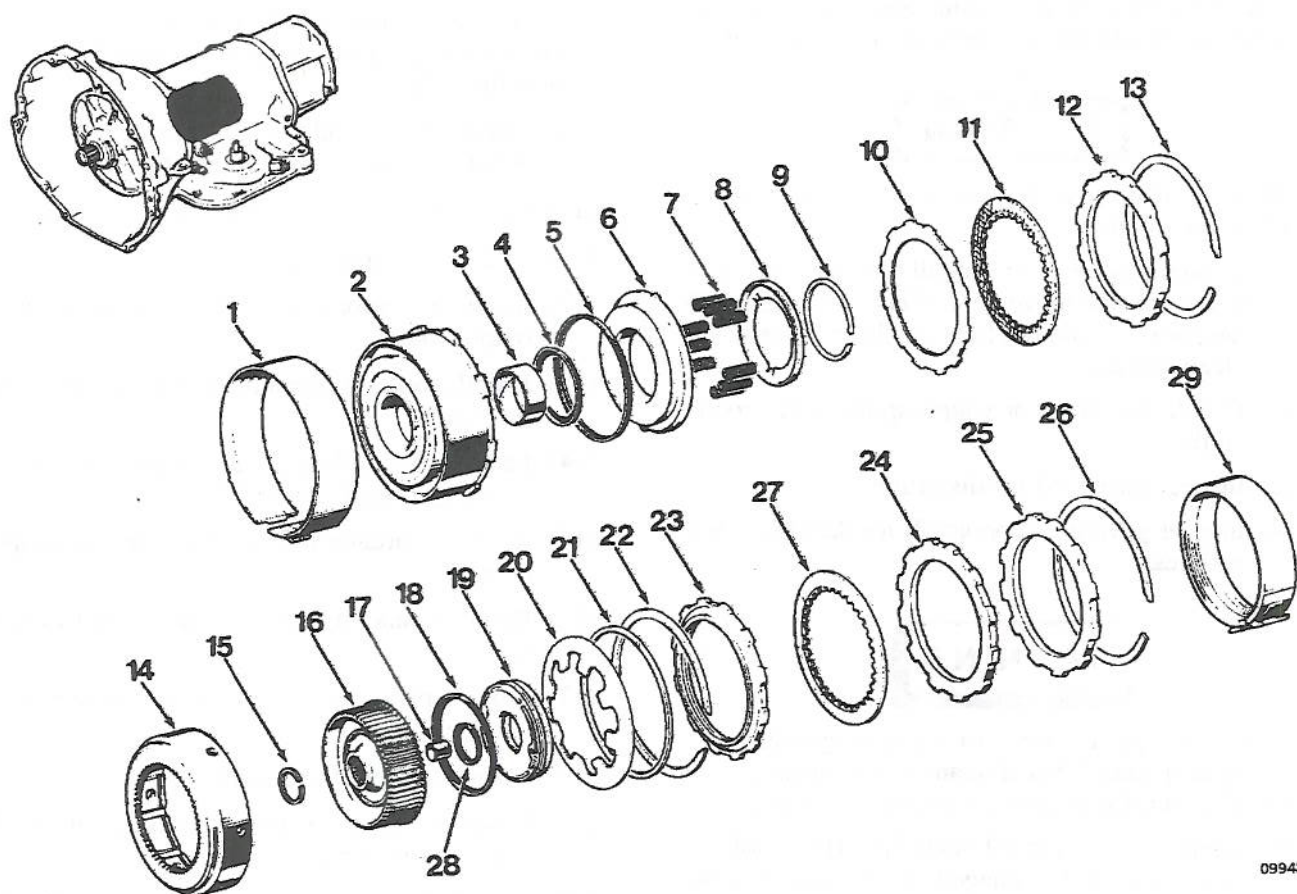
NOTE

The capscrews must not be tightened to a specific torque until the assembly is installed on the output shaft.

- (9) Install inner weight (8) and spring (9) in outer weight (10) and install retaining ring (6).
- (10) Install outer weight (10) in governor body (3).
- (11) Install retaining ring (7).
- (12) Install governor body (3) and support (2) on output shaft.
- (13) Install retaining ring attaching governor to output shaft.
- (14) Install valve (14) and valve shaft (12). Install retaining rings (5) and (12).
- (15) Refer to paragraph 5-5.8.1 and install adapter housing.
- (16) Refer to paragraph 5-5.3.2 and install transfer case.
- (17) Refer to paragraph 5-5.8.1 and install rear cross-member.
- (18) Connect speedometer cable.
- (19) Connect exhaust support brackets and brake cable, if removed.
- (20) Refer to paragraph 5-5.3.1 and connect propeller shaft.
- (21) Refer to paragraphs 5-5.2.1 and 5-5.2.2 and adjust gearshift and throttle linkage.
- (22) Lower vehicle.
- (23) Fill transmission with transmission fluid.

5-5.2.8 *Clutches Group*. Refer to figure 5-82, and perform the following steps to overhaul the clutches group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove clutches group as follows:
- (1) Refer to paragraph 5-5.2.4 and remove transmission assembly from vehicle.
 - (2) Mount transmission assembly in holding fixture #J-24026.
 - (3) Refer to paragraph 5-5.2.9 and remove gears and shafts components as necessary to reach clutch group.
 - (4) Loosen adjusting screw on kickdown band assembly (1) and remove band strut and band.
 - (5) Remove front clutch assembly.



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|---------------------------|-------------------------|---------------------------|
| 1. Kickdown Band Assembly | 11. Clutch Disc | 21. Spring Spacer |
| 2. Retainer Assembly | 12. Clutch Disc | 22. Retaining Ring |
| 3. Bushing | 13. Retaining Ring | 23. Clutch Disc |
| 4. Seal | 14. Clutch Retainer | 24. Clutch Plate |
| 5. Seal | 15. Seal Ring | 25. Pressure Plate |
| 6. Piston | 16. Piston Retainer | 26. Retaining Ring |
| 7. Piston Spring | 17. Input Shaft Bushing | 27. Clutch Disc |
| 8. Spring Retainer | 18. Piston Seal | 28. Seal |
| 9. Retaining Ring | 19. Piston Assembly | 29. Brake Band and Lining |
| 10. Clutch Disc | 20. Piston Spring | |

Figure 5-82. Clutches Group

- (6) Remove input shaft bushing (17) and rear clutch assembly by grasping input shaft bushing (17) and pulling assembly straight out of case.
- (7) Remove retaining ring (13) and remove clutch disc (12).
- (8) Remove clutch disc (11) and clutch disc (10).
- (9) Install compressor tool #J-24042 over spring retainer (8).
- (10) Compress piston springs (7) and remove retaining ring (9).
- (11) Slowly release compressor tool until spring retainer (8) is free of hub.

NOTE

Do not allow the spring retainer to stick or bind in the snap ring groove.

- (12) Remove compressor tool, retainer (8) and springs (7).
- (13) Turn retainer assembly (2) over and bump on wood block to dislodge and remove seal (6).
- (14) Remove seals (4) and (5) and bushing (3) from retainer assembly (2).
- (15) Loosen adjusting screw on brake band and lining (29) and remove brake band and lining (29).
- (16) Remove retaining ring (26).
- (17) Remove pressure plate (25), clutch plate (24), clutch disc (27) and clutch disc (23).
- (18) Remove retaining ring (22), spring spacer (21) and piston spring (20).
- (19) Turn clutch retainer (14) upside down and bump on wood block to remove piston assembly (19).
- (20) Remove piston seals (18) and (28).
- (21) Remove seal ring (15) and remove input shaft.



Do not clamp the seal ring band on bearing journal.

- (22) Clamp input shaft in vise using brass protective jaws.
- (23) Thread bushing remover tool #J-24041 straight into input shaft bushing (17) as far as possible by hand.
- (24) Using wrench, thread puller into input shaft bushing (17) three to four additional turns to fully engage puller threads in input shaft bushing (17).
- (25) Thread slide hammer bolts tool #J-7004-3 into puller.
- (26) Bump outward with slide hammers to remove input shaft bushing (17).
- (27) Grip old input shaft bushing (17) with pliers and remove it from tool.

NOTE

Be careful to protect the remover tool threads when using the tool.

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, thoroughly clean input shaft and remove chips generated by input shaft bushing (17) removal. Perform the following steps:

- (1) Inspect friction material on driving discs to see if they are cleaned, glazed, heavily pitted or flaking or if friction material can be scraped off easily.
- (2) Inspect clutch disc (10), clutch plate (24), clutch disc (12), clutch disc (23) and pressure plate (25) for overheating, scoring and damaged lugs.
- (3) Inspect clutch discs (10), (11), (24) and (27) for distortion.
- (4) Inspect lug grooves in retainer assembly (2) and clutch retainer (14) to make sure surfaces are smooth. The plates must slide smoothly in these grooves.
- (5) Inspect the clutch piston check ball to see that it moves freely in its cage.
- (6) Inspect seal ring surface in retainer assembly (2) and clutch retainer (14) for nicks or deep scratches. Light scratches will not interfere with sealing.
- (7) Inspect piston spring (7), retaining ring (22) and spring spacer (21) for distortion or breakage.
- (8) Inspect seal ring grooves in input shaft, retainer assembly (2) and piston retainer (16) for nicks, burrs and wear.
- (9) Measure thickness of rear clutch to front clutch thrust washer. Compare measurement to figure specified in table 6-1.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install the clutches group as follows:
 - (1) Thread bushing installer tool #J-24040 onto driver handle #J-8092.
 - (2) Position replacement input shaft bushing (17) on installer tool and install bushing straight into shaft until tool bottoms.
 - (3) Clean input shaft bushing (17) thoroughly.
 - (4) Press input shaft bushing (17) into piston retainer (16) and install seal ring (15).

- (5) Lubricate piston seals (18) and (28) with petroleum jelly and install on piston assembly (19).

NOTE

Be sure that the lips of the seals face into retainer bore and that seals are properly seated in piston grooves.

- (6) Install piston assembly (19) in piston retainer (16).
- (7) Seat piston at bottom of retainer bore using twisting motion.
- (8) Position clutch retainer (14) over piston retainer (16) splines. Support assembly to maintain position of clutch retainer (14).
- (9) Install piston spring (20) in clutch retainer (14) with spring fingers touching piston.
- (10) Install spring spacer (21). Be sure spring (20) and spacer (21) are centered in retainer recess.
- (11) Install one end of retaining ring (22) in retainer (14) groove. Progressively push or tap ring into clutch retainer until completely seated.

NOTE

If necessary, gently tap the piston spring and spacer to keep them centered.

- (12) Install clutch disc (23). Raised side of disc (23) should rest on piston spring (20) and flat surface should face outward.
- (13) Lubricate clutch disc (27) and clutch plates (24) with transmission fluid and install in retainer (14). Alternately install clutch discs (27) and clutch plates (24) until correct number of plates have been installed.
- (14) Install pressure plate (25) and retaining ring (26).
- (15) Measure clutch pack clearance. Press down firmly on pressure plate (25) and retaining ring (26). Insert feeler gauge between pressure plate (25) and retaining ring (26).
- (16) If clutch pack clearance exceeds figures specified by table 6-1, replace retaining ring with one of appropriate thickness to provide proper clearance.
- (17) Install brake band and lining (29).

- (18) Place retainer assembly (2) open end down on clean, smooth surface.
- (19) Insert bushing remover/installer tool #J-24039 into bushing (3).
- (20) Install driver handle #J-8092 in tool #J-24039.
- (21) Position clutch retainer so open end faces upward.
- (22) Install bushing (3) straight into retainer bore until bushing (3) is flush with base of bore chamber.
- (23) Lubricate seal (4) with petroleum jelly and install it on hub of retainer assembly (2).

NOTE

Be sure the seal lip faces into the piston bore and is properly seated in the seal groove.

- (24) Lubricate seal (5) with petroleum jelly and install it on piston (6) with seal lip facing into piston bore.
- (25) Install piston (6) in retainer assembly (2) and carefully seat piston at bottom of retainer (2) bore.
- (26) Install piston springs (7) on piston (6).
- (27) Install spring retainer (8) and retaining ring (9).
- (28) Install compressor tool #J-24042 over retainer assembly (2).
- (29) Compress piston springs (7) and seat retaining ring (9).
- (30) Remove compressor tool.
- (31) Lubricate clutch discs (10) and (11) with transmission fluid.
- (32) Install clutch discs (10) and (11) alternately until correct numbers are installed.
- (33) Install clutch disc (12) and retaining ring (13).
- (34) Measure clutch pack clearance using feeler gauge. If clearance is not within limits specified by table 6-1, disassemble clutch pack and measure thickness of clutch discs (10) and (11) and retaining ring (13). Compare those measurements to measurements listed in table 6-1. Replace any components that do not meet these specifications.
- (35) Install kickdown band assembly (1) and tighten adjusting screw to torque specified by table 6-2.

- (36) Install clutch group in transmission assembly.
- (37) Refer to paragraph 5-5.2.9 and install gears and shafts components removed during removal.
- (38) Remove transmission assembly from holding fixture.
- (39) Refer to paragraph 5-5.2.4 and install transmission.

5-5.2.9 Gears and Shafts Group. Refer to figure 5-83, and perform the following steps to overhaul the gears and shafts group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove gears and shafts group as follows:

- (1) Refer to paragraph 5-5.2.4 and remove transmission assembly from vehicle.

NOTE

Measuring end play before disassembly will indicate whether a thrust washer change is required and will save time at assembly.

- (2) Mount transmission assembly in holding fixture #J-24026.
- (3) Remove one capscrew (3), and thread dial indicator support rod #J-5864 into bolt hole.
- (4) Attach dial indicator #J-8001 to rod.
- (5) Position indicator stylus against forward end of input shaft.
- (6) Move input shaft rearward and set dial indicator at zero.
- (7) Pull input shaft (15) forward to obtain end play reading.
- (8) Record reading for future reference.
- (9) Remove dial indicator and rod.
- (10) Refer to paragraph 5-5.2.4 and remove oil pan.
- (11) Refer to paragraph 5-5.2.6 and remove valve body.
- (12) Refer to paragraph 5-5.2.6 and remove accumulator piston and spring.
- (13) Refer to paragraph 5-5.2.7 and remove governor and support.
- (14) Tighten front band adjusting screw until band is tight around front clutch retainer. This pre-

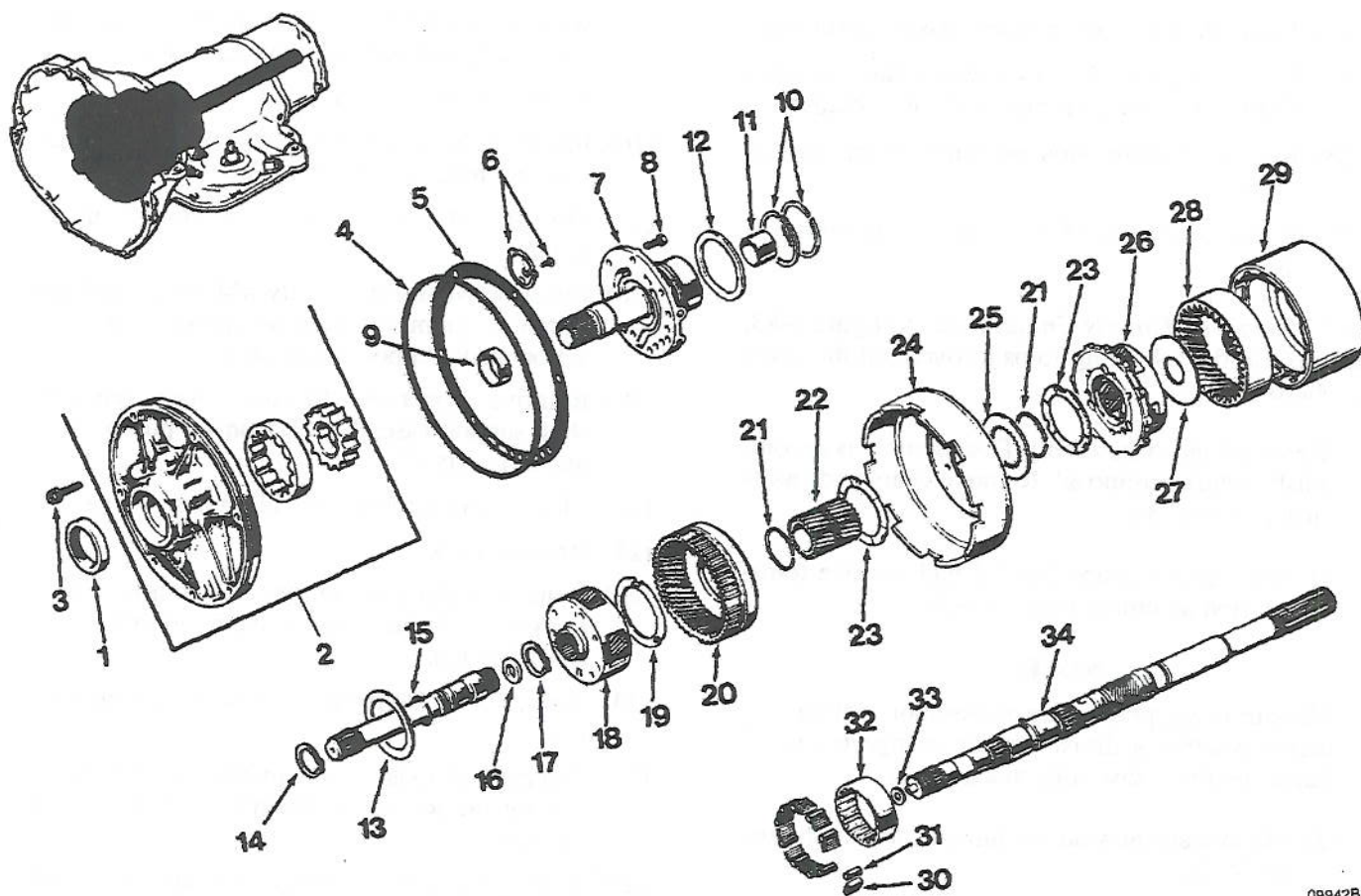
sents front clutch assembly from coming out with pump and damaging clutch discs.

- (15) Remove capscrew (3).
- (16) Install slide hammer tool #J-6585-1 on slide hammer bolts tool #J-7004-3.
- (17) Thread bolts into holes in oil pump housing flange.
- (18) Bump outwardly and evenly with slide hammers to remove pump housing assembly (2) and reaction shaft support assembly (7).
- (19) Remove capscrews (8) and remove reaction shaft support assembly (7) from oil pump housing assembly (2).
- (20) Mark rotors for assembly alignment reference.
- (21) Remove rotors.
- (22) Remove baffle package (6) and remove housing gasket (5) and seal (4) from pump housing assembly (2).
- (23) Remove seal (1) from pump housing assembly (2).
- (24) Place pump housing with reaction shaft support mating surface facing downward on flat, level surface.
- (25) Remove bushing (9) using remover/installer tool #J-24055 and driver handle #J-8092.



Do not clamp any part of the reaction-shaft support assembly in a vise.

- (26) Remove support seal rings (10) and thrust washer (12).
- (27) Thread bushing remover tool #J-24037 into bushing as far as possible by hand.
- (28) Using wrench, thread remover tool into bushing (11) three or four additional turns to fully engage threads of tool in bushing (11).
- (29) Install slide hammer bolts tool #J-7004-3 and slide hammer tool #J-6585-1 into remover tool. Bump outward with slide hammers to remove bushing (11).
- (30) Thoroughly clean reaction shaft support assembly (7) after bushing removal.
- (31) Remove retaining ring (14). Refer to paragraph 5-5.2.8 and remove front band and front clutch.



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|------------------------------------|---------------------------------|--------------------------------|
| 1. Seal | 12. Thrust Washer | 23. Thrust |
| 2. Oil Pump Housing Assembly | 13. Thrust Washer | 24. Driving Shell |
| 3. Capscrew | 14. Retaining Ring | 25. Thrust Plate |
| 4. Seal | 15. Input Shaft Assembly | 26. Rear Carrier Assembly |
| 5. Gasket | 16. Thrust Washer | 27. Thrust Plate |
| 6. Baffle Package | 17. Retaining Ring | 28. Rear Annulus Gear Assembly |
| 7. Reaction Shaft Support Assembly | 18. Planetary Carrier Assembly | 29. Reverse Drum |
| 8. Capscrew | 19. Carrier Thrust Washer | 30. Spring |
| 9. Bushing | 20. Front Annulus Gear Assembly | 31. Roller |
| 10. Support Seal Ring | 21. Sun Gear Lockring | 32. Race |
| 11. Bushing | 22. Sun Gear Assembly | 33. Thrust Washer |
| | | 34. Output Shaft |

Figure 5-83. Gears and Shafts Group

- (32) Remove thrust washer (13), input shaft assembly (15) and rear clutch assembly by grasping input shaft and pulling straight out of case.
- (33) Remove thrust washers (16) and (33).
- (34) Remove retaining ring (17).
- (35) Remove race (32), rollers (31) and springs (30). Refer to paragraph 5-5.2.4 and remove overrunning clutch kit.
- (36) Remove planetary carrier assembly (18), carrier thrust washer (19) and front annulus gear assembly (20).
- (37) Remove lockring (21), sun gear assembly (22) and thrust washer (23).
- (38) Remove driving shell (24).
- (39) Remove thrust plate (25).
- (40) Remove lockring (21) and thrust washer (23).
- (41) Remove carrier assembly (26) and output shaft (34).
- (42) Remove rear annulus thrust plate (27).
- (43) Remove rear annulus gear assembly (28).
- (44) Remove reverse drum (29).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:
 - (1) Inspect pump rotors for wear and scores.
 - (2) Install pump rotors in pump body. Position straightedge across rotor faces and pump body, and use feeler gauge to measure clearance between straightedge and rotors. Check that clearance is between figures specified in table 6-1.
 - (3) Position inner and outer rotors so that center of one tooth on each rotor is aligned and measure clearance between tips of teeth. Make fan measurements. Rotate inner rotor approximately 1/4 turn between measurements. Rotor tip clearance should be between figures specified by table 6-1.
 - (4) Measure clearance between outer surface of outer rotor and pump bore. Clearance should be between figures specified by table 6-1.
 - (5) If reaction shaft bushing (11) requires replacement, also inspect shaft and support bore for wear caused by input shaft seal ring

bands. If bore is worn or grooved, entire reaction shaft support assembly (7) must be replaced.



Do not clamp any part of the reaction shaft or support in a vise.

- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install gears and shafts group as follows:
 - (1) Install rear drum (29) in transmission housing.
 - (2) Install rear annulus gear assembly (28).
 - (3) Install rear annulus thrust plate (27).
 - (4) Install carrier assembly (26) on output shaft (34) and install output shaft (34).
 - (5) Install thrust washer (23) and install lockring (21).
 - (6) Install thrust plate (25).
 - (7) Install driving shell (24).
 - (8) Install thrust washer (23), sun gear assembly (22) and lockring (21).
 - (9) Install front annulus gear assembly (20), carrier thrust washer (19) and planetary carrier assembly (18).
 - (10) Refer to paragraph 5-5.2.4 and install overrunning clutch kit.
 - (11) Install springs (30), rollers (31) and race (32).
 - (12) Install retaining ring (17).
 - (13) Install thrust washers (33) and (16).
 - (14) Install rear clutch assembly, input shaft assembly (15) and thrust washer (13).
 - (15) Refer to paragraph 5-5.2.8 and install front band and front clutch; install retaining ring (14).
 - (16) Thread bushing installer tool #J-24038 onto driver handle #J-8092.
 - (17) Position bushing (11) on installer tool and install bushing straight into shaft bore until tool bottoms.

NOTE

If transmission end play reading obtained during disassembly was not within limits specified by table 6-1, replace thrust washer on reaction shaft support hub, one that will provide correct end play.

- (18) Install thrust washer (12) and support seal rings (10).
- (19) Install bushing (9).
- (20) Install pump rotors in oil pump housing.
- (21) Install reaction shaft support assembly (7) in oil pump housing assembly (2) using capscrews (8). Tighten capscrews to torque specified by table 6-2.
- (22) Install two pilot studs tool #J-3387-2 (figure 5-81) into case pump opening.
- (23) Install seal (1) in pump housing assembly (2).
- (24) Install seal (4) in outer flange of pump housing assembly (2). Coat seal with petroleum jelly.
- (25) Install gasket (5) using baffle package (6).
- (26) Install pump assembly (2) in transmission case.
- (27) Position deflector, if equipped, over vent opening and install four screws and washers (3) finger tight.
- (28) Remove pilot studs and install remaining screws and washers (3) finger tight.
- (29) Rotate input shaft (15) and output shaft (34) to see if any binding occurs.
- (30) If shafts rotate freely, tighten all screws and washers (3) to torque specified by table 6-2.
- (31) Recheck shafts for free rotation. If bind exists, loosen screws and washers (3) and tighten screws alternately and evenly to torque specified by table 6-2.
- (32) Refer to paragraph 5-5.2.7 and install governor and support.
- (33) Refer to paragraph 5-5.2.6 and install accumulator piston and spring.
- (34) Refer to paragraph 5-5.2.6 and remove valve body.
- (35) Refer to paragraph 5-5.2.4 and remove oil pan.
- (36) Remove transmission assembly from holding fixture #J-24026.

- (37) Refer to paragraph 5-5.2.4 and install transmission assembly in vehicle.

5-5.3 Transfer Case and Propeller Shaft.

5-5.3.1 Rear Propeller Shaft Group. Refer to figure 5-84, and perform the following steps to overhaul the rear propeller shaft group.

- a. Removal. Remove rear propeller shaft group as follows:

WARNING

Do not work under raised vehicle without first supporting vehicle with safety jack stands or injury to personnel may result.

- (1) Raise vehicle.
- (2) Mark propeller shaft (3), transfer case and yoke (7) for assembly alignment reference.

WARNING

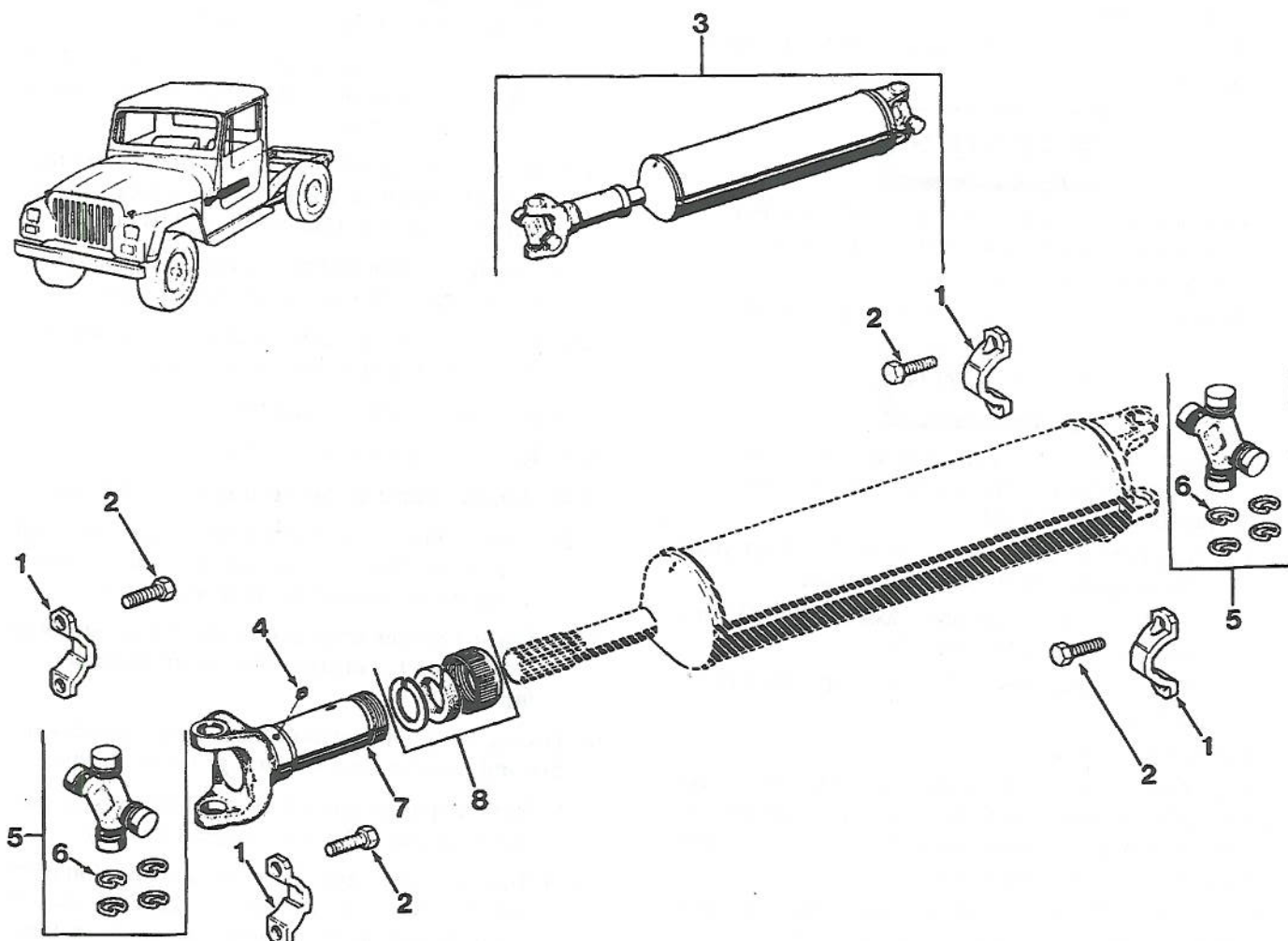
Support rear propeller shaft assembly with safety jack stands before removing straps or injury to personnel may result.

- (3) Remove capscrews (2), straps (1) and rear propeller shaft assembly (3).
- b. Disassembly. Disassemble rear propeller shaft group as follows:

CAUTION

Do not clamp propeller shaft tube in the vise. Clamp only the forged portion of the yoke in the vise. Do not overtighten vise or damage to propeller shaft will result.

- (1) Mount propeller shaft yoke (7) in vise.
- (2) Remove retaining rings (6) from spider assemblies (5). Tap on ends of spider assembly (5) with hammer to relieve pressure on retaining rings, if necessary.
- (3) Tap end of one arm of spider assembly (5) until bearing cap comes off opposite arm of spider assembly (5).
- (4) Remove spider assembly (5) and lubrication fitting (4) from yoke (7).
- (5) Repeat steps (3) and (4) for remaining spider assembly (5).
- (6) Remove yoke (7) and seal kit (8).
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:



09800B

1. Straps
2. Capscrews

3. Propeller Shaft
4. Lubrication Fitting

5. Spider Assemblies
6. Retaining Rings

7. Propeller Shaft Yoke
8. Kit

Figure 5-84. Rear Propeller Shaft Group

- (1) Wash the spider assemblies (5) in solvent (9, table 5-1,) and wipe dry with a clean shop cloth.
- (2) Remove all rust, corrosion and dirt from rear propeller shaft assembly (3).
- (3) Inspect spider assemblies (5) for excessive wear, flat spots, scoring or cracks.
- d. Repair and replacement. Replace all worn or damaged parts, including all parts found defective during inspection procedures.
- e. Assembly. Assemble rear propeller shaft group as follows:
 - (1) Lubricate surfaces of spider assemblies (5) with chassis grease.
 - (2) Install yoke (7) and seal kit (8).
 - (3) Position arm of spider assembly (5) in yoke (7). Use arm without bearing cap.
 - (4) Install loose bearing cap in yoke (7).
 - (5) Support yoke (7) on vise jaws and seat bearing cap and spider assembly (5) with a hammer. Install lubrication fitting (4).
 - (6) Install retaining rings (6) on spider assembly (5). Tap ends of spider assembly (5) arms with hammer, if necessary.

- (7) Repeat steps (3) through (6) for remaining spider assembly (5).
- f. Installation. Install rear propeller shaft group as follows:

WARNING

Do not work under raised vehicle without first supporting vehicle with safety jack stands or injury to personnel may result.

- (1) Raise vehicle and support with jack stand.

WARNING

Support rear propeller shaft assembly with safety jack stands before installing straps or injury to personnel may result.

- (2) Align reference marks on propeller shaft yoke (7), propeller shaft and transfer case.
- (3) Install rear propeller shaft assembly (13) with straps (1) and capscrews (2).
- (4) Tighten capscrews (2) to torque specified in table 6-2.
- (5) Lower vehicle.

5-5.3.2 Transfer Case Assembly and Transfer Case Housing Group. Refer to figure 5-85, and perform the following steps to overhaul the transfer case assembly and transfer case housing group.

- a. Removal. Remove transfer case assembly and transfer case housing group as follows:

WARNING

Do not work under raised vehicle without first supporting vehicle with safety jack stands or injury to personnel may result.

- (1) Raise vehicle and support with jack stands.
- (2) Position drain pan under transfer case and remove plug and gasket assemblies (16) to drain transmission fluid.
- (3) Refer to paragraph 5-5.10.11 and disconnect speedometer cable and indicator switch wires; disconnect transfer case shift lever link at operating lever.

WARNING

Do not remove rear crossmember without adequate support under the transmission or injury to personnel may result.

- (4) Support transmission and transfer case assembly (1) with suitable bracing; refer to paragraph 5-5.8.1 and remove rear crossmember.
- (5) Mark transfer case front and rear output shaft yokes and rear propeller shaft for assembly alignment reference.
- (6) Refer to paragraph 5-5.3.1 and disconnect rear propeller shaft at transfer case yokes. Secure propeller shaft to frame rails with wire.
- (7) Disconnect parking brake cable guide from pivot located on right frame rail, if necessary.
- (8) Remove bolts attaching exhaust pipe support bracket to transfer case, if necessary.
- (9) Remove clamps (3) and hose (2).
- (10) Remove clips (6) and vent line (5).
- (11) Remove transfer case-to-transmission bolts.
- (12) Move transfer case assembly (1) rearward until free of transmission output shaft and remove transfer case assembly (1) from vehicle.
- (13) Place transfer case assembly (1) on suitable work table for disassembly using suitable lifting device.

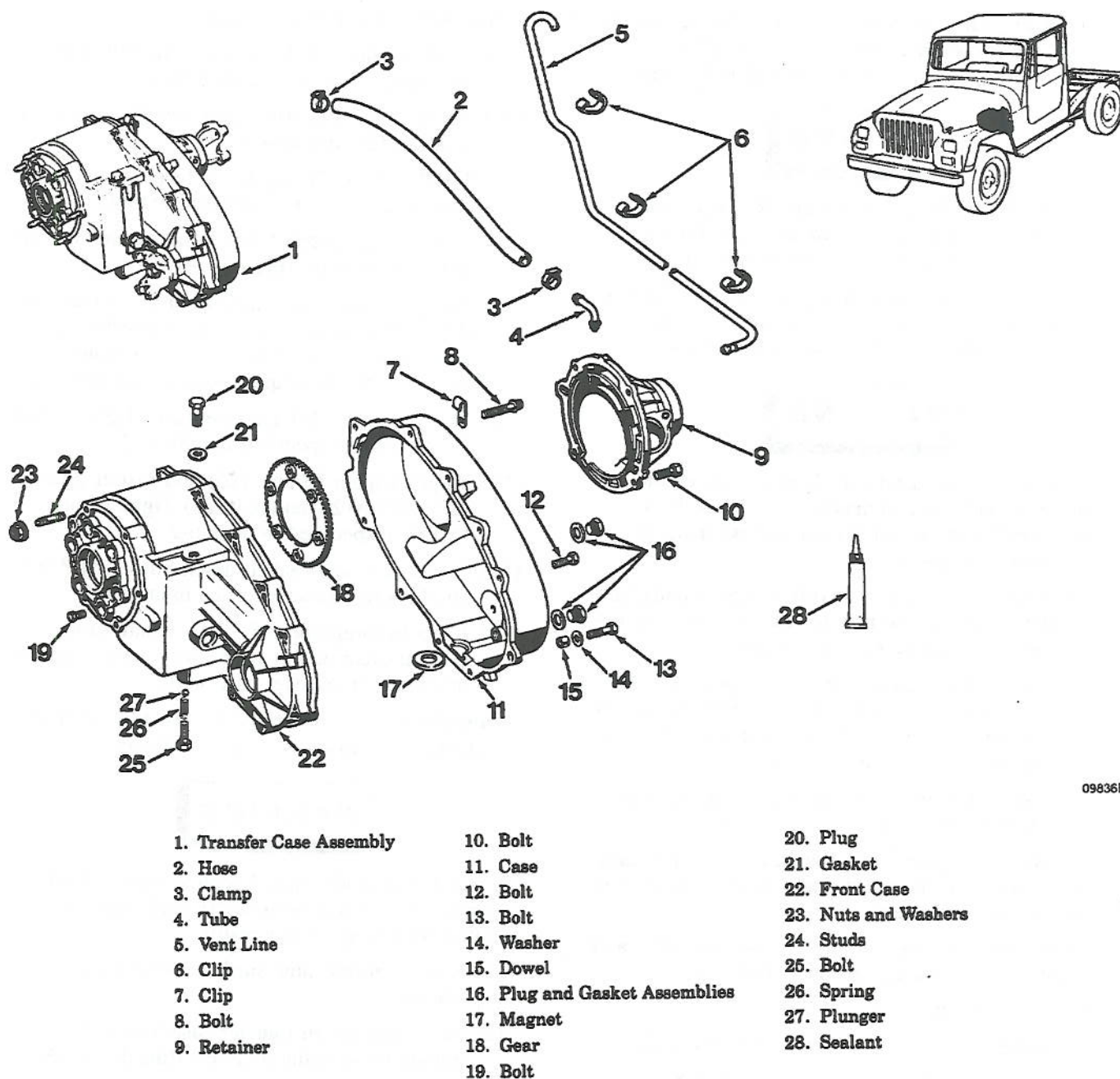
- b. Disassembly. Disassemble the transfer case assembly and transfer case housing group as follows:

- (1) Refer to paragraph 5-5.3.3 and remove rear output yoke and yoke and slinger assembly.
- (2) Turn case assembly (1) on end and position front case on wood blocks. Cut "V" case notches in wood blocks to clear mounting studs in front case (22), if necessary.
- (3) Remove plug (20), gasket (21) and tube (4).
- (4) Remove bolt (25), spring (26) and plunger (27).

CAUTION

Use a rawhide or plastic mallet when tapping the retainer. Do not attempt to use a pry bar to remove retainer or damage to retainer or case may result.

- (5) Mark retainer (9) for assembly alignment and remove bolts (10) and rear bearing retainer (9). Tap retainer with mallet to loosen.
- (6) Refer to paragraph 5-5.3.3 for disassembly of parts in retainer (9).
- (7) Remove bolt (8) and clip (7).
- (8) Remove bolts (13), washers (14) and dowels (15).
- (9) Remove bolts (12).



09836B

Figure 5-85. Transfer Case Assembly and Transfer Case Housing Group

CAUTION

Do not attempt to wedge case halves apart at any point on mating surfaces or damage to surface may result.

- (10) Remove case (11) by inserting suitable tool in slots cast in ends of case (11) and gently prying upward.

- (11) Refer to paragraph 5-5.3.3 for removal and disassembly of transfer case gears and shaft.
 (12) Remove bolts (19) and gear (18).
 (13) Remove nuts and washers (23) and studs (24).
 (14) Remove magnet (17).

- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures. In addition, perform the following steps:

WARNING

P-D-680 Type II is toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Good general ventilation is normally adequate.

- (1) Wash all parts thoroughly in P-D-680 Type II (7, table 5-1), removing all old lubricant, metallic particles, dirt or foreign materials.

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi and wearing of goggles is required.

- (2) Apply compressed air to oil feed ports and channels in each case half to remove any obstructions or cleaning solvent residue.
 - (3) Inspect case halves for cracks, porosity, damaged mating surfaces, stripped bolt threads or distortion. If any of these conditions exist, replacement of case half is required.
 - (4) Inspect bearing bores and rear bearing retainer (91) for excessive wear or damage.
- d. Repair and replacement. Replace all worn or damaged parts, including all parts found defective in inspection procedures above.
- e. Assembly. Assemble transfer case assembly and transfer case housing group as follows:
- (1) Install magnet (17).
 - (2) Install studs (24) and nuts and washers (23).
 - (3) Coat case (22) and surfaces of plate (18) around bolt holes with sealant (28).
 - (4) Align gear (18) with bolt holes and position gear (18) in case (22).
 - (5) Coat bolts (19) with sealant and install gear (18); tighten bolts (19) to torque specified in table 6-2.
 - (6) Refer to paragraph 5-5.3.3 and install transfer case gears and shaft.

CAUTION

Be sure front output shaft rear thrust bearing assembly is seated in the rear case before connecting case halves or damage to thrust bear-

ings, gears and shaft may result.

- (7) Apply sealant (28) to mating surface of case (22) and install case (11) on case (22).
 - (8) Align case bolt holes and install bolts (13), washers (14) and dowels (15).
 - (9) Install bolts (12). Tighten bolts (12) alternately and evenly to torque specified in table 6-2.
 - (10) Refer to paragraph 5-5.3.3 and assemble parts that go in rear bearing retainer (9).
 - (11) Apply sealant (28) to mating surface of retainer (9), align retainer (9) and case (11) index marks, and install retainer (9) with four bolts (10). Tighten bolts to torque specified in table 6-2.
 - (12) Install gasket (21) and plug (20). Tighten plug (20) to torque specified in table 6-2.
 - (13) Apply sealant to bolt (25) and install plunger (27), spring (26) and bolt (25). Tighten bolt (25) to torque specified in table 6-2.
 - (14) Install plug and gaskets assemblies (16). Tighten plugs to torque specified in table 6-2.
 - (15) Refer to paragraph 5-5.3.3 for installation of all oil seals, rear output yoke, and yoke and slinger assembly on transfer case shafts.
- f. Installation. Install transfer case assembly and transfer case housing group as follows:

WARNING

Do not work under raised vehicle without first supporting vehicle with safety jack stands or injury to personnel may result.

- (1) Raise vehicle and support with safety jack stands.
- (2) Align and install transfer case assembly (1) on transmission, using suitable lifting device. Align transfer case input gear splines with transmission output shaft. Rotate transfer case rear output shaft, if necessary, to align splines.

CAUTION

Be sure the transfer case is flush against the transmission before tightening attaching bolts. Severe damage to transfer case will result if the attaching bolts are tightened while transfer case is cocked or in a bind.

- (3) Align and install transfer case-to-transmission bolts. Tighten bolts to torque specified in table 6-2.

- (4) Install tube (4).
- (5) Install tube (2) with clamps (3).
- (6) Install line (5) with clip (6).
- (7) Attach exhaust pipe support bracket to transfer case assembly.
- (8) Refer to paragraph 5-5.3.1 and connect rear propeller shafts at transfer case yokes.
- (9) Connect parking brake cable guide to pivot bracket on frame rail.
- (10) Refer to paragraph 5-5.10.11 and install speedometer cable and indicator switch wires. Connect transfer case shift lever link to operating lever.
- (11) Refer to paragraph 5-5.8.1 and install rear cross-member. Remove transmission support bracing.
- (12) Fill transfer case assembly with transmission fluid, Dexron II.
- (13) Lower vehicle with suitable lifting device.

5-5.3.3 Transfer Case Gears and Shafts. Refer to figure 5-86 and perform the following steps to overhaul the transfer case gears and shafts.

- a. Removal and disassembly. Disassembly is accomplished during removal. Refer to paragraph 5-5.3.2, and remove transfer case assembly from vehicle. Disassemble transfer case assembly only as far as removing the rear case half from the front case half so that the transfer case assembly is situated with the rear side facing up and the gears and shafts still in the front case half. Removal procedures for the rear output yoke (33) and yoke and slinger assembly are listed below, although they must be accomplished prior to removal of front and rear case halves. Remove transfer case gears and shafts as follows:

- (1) Remove nut (35) and lockwasher (34), using tool #J-8614-01 to hold yoke while removing nut (35).
- (2) Remove yoke (33), using tools #J-8614-01, -02 and -03, if necessary.

NOTE

Rear bearing retainer should already be removed in accordance with procedures in paragraph 5-5.3.2.

- (3) Remove gear (6) from rear bearing retainer.

- (4) Remove pump housing (29) from rear bearing retainer and remove packing assembly (28) and housing (29).
- (5) Remove retaining ring (30), bearing (31) and seal (32) from rear bearing retainer.

NOTE

When removing oil pump, note position of pump for assembly reference.

- (6) Remove gear set (5).

NOTE

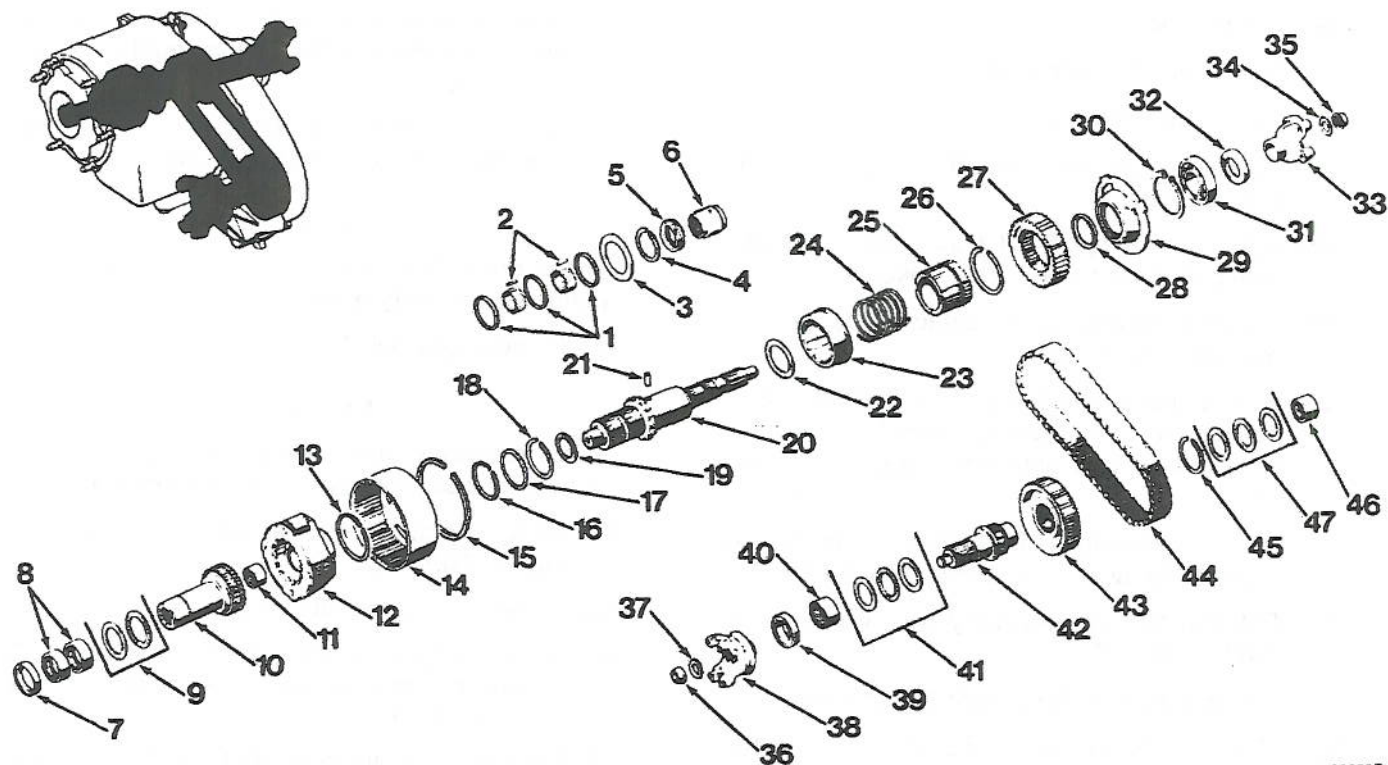
When removing thrust bearing, note position of bearing and races for assembly reference.

- (7) Remove rear thrust bearings (47) from front output shaft (42).
- (8) Remove retaining ring (45).
- (9) Remove chain (44) and sprockets (43) and (27) by lifting evenly on chain (44) and sprockets (43) and (271).
- (10) Remove front output shaft (42) and front thrust bearings (41).
- (11) Remove sprocket stop ring (26) and mode shift spring (24).

NOTE

Sliding clutch should be removed with mode fork, rail spring and bracket.

- (12) Refer to paragraph 5-5.3.4 and remove sliding clutch (23), mode fork, rail spring and bracket as an assembly. Remove shift rail.
- (13) Remove sprocket carrier (25), retaining ring (4), thrust washer (3), rollers (2) and roller spacers (1) all together.
- (14) Remove retaining ring (16), thrust washer (17), retaining ring (18) and roller and retainer (19).
- (15) Remove mainshaft assembly (20) by lifting mainshaft assembly straight up and out of case.
- (16) Remove pin (21) and thrust washer (22).
- (17) Remove retaining ring (15) and hub assembly (14).
- (18) Remove retaining ring (13) and gear assembly (12).
- (19) Remove roller and retainer (9) and input gear assembly (10).



09868B

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|-------------------------|---------------------------------|--------------------------|
| 1. Roller Spacer | 17. Thrust Washer | 33. Yoke |
| 2. Roller | 18. Retaining Ring | 34. Lockwasher |
| 3. Thrust Washer | 19. Retainer and Roller Bearing | 35. Nut |
| 4. Retaining Ring | 20. Mainshaft Assembly | 36. Nut |
| 5. Gear Set | 21. Pin | 37. Washer |
| 6. Gear | 22. Thrust Washer | 38. Yoke and Slinger |
| 7. Oil Seal | 23. Sliding Clutch | 39. Seal |
| 8. Bearing | 24. Mode Shift Spring | 40. Bearing |
| 9. Retainer and Roller | 25. Sprocket Carrier | 41. Front Thrust Bearing |
| 10. Input Gear Assembly | 26. Sprocket Stop Ring | 42. Front Output Shaft |
| 11. Roller Bearing | 27. Sprocket | 43. Sprocket |
| 12. Gear Assembly | 28. Packing Assembly | 44. Chain |
| 13. Retaining Ring | 29. Housing | 45. Retaining Ring |
| 14. Hub Assembly | 30. Retaining Ring | 46. Bearing |
| 15. Retaining Ring | 31. Bearing | 47. Rear Thrust Bearings |
| 16. Retaining Ring | 32. Seal | |

Figure 5-86. Transfer Case Gears and Shafts

- (20) Remove roller bearing (11), using slide hammer #J2619-01 and remover #J-29369-1, if necessary, as shown in figure 5-87.
- (21) Remove oil seal (7, figure 5-86).
- (22) Remove nut (36) and washer (37) using tool #J-8614-01 to hold yoke while removing nut (36).
- (23) Remove yoke and slinger assembly (38), using tools #J-8614-01, -02 -03, as necessary.
- (24) Remove seal (39).
- (25) Remove bearing (40), using tools #J-8092 and #J-29168, as shown in figure 5-88.

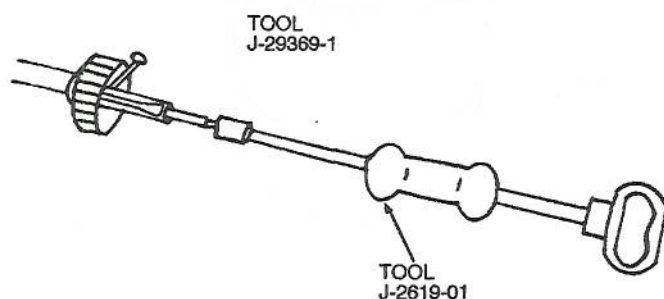


Figure 5-87. Mainshaft Pilot Bearing Removal

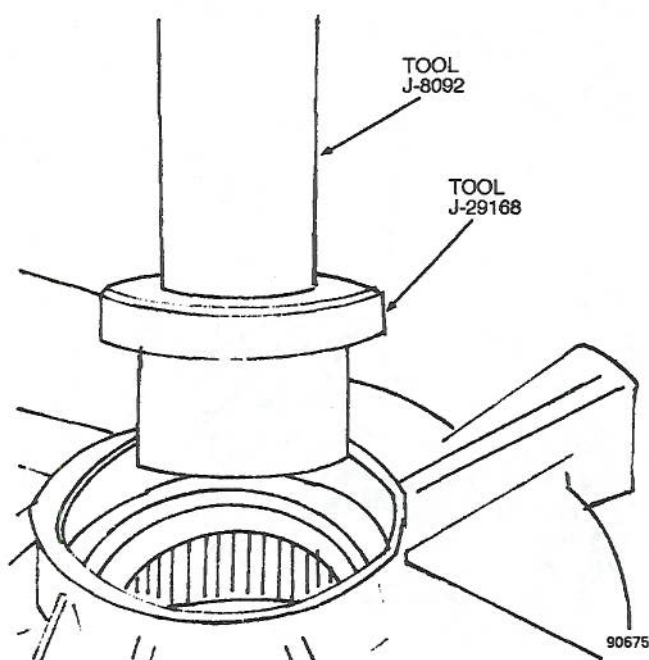


Figure 5-88. Front Output Shaft Front Bearing Removal

- (26) Remove bearing (46, figure 5-86), using remover tool #J-26941 and slide hammer #J2619-01, as shown in figure 5-89.
- (27) Remove two bearings (8, figure 5-86) at the same time, using drive handle #J-8092 and remover #J-29170, as shown in figure 5-90.
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Installation of the transfer case gears and shafts is accomplished during assembly. Assemble the transfer case gears and shafts as follows:

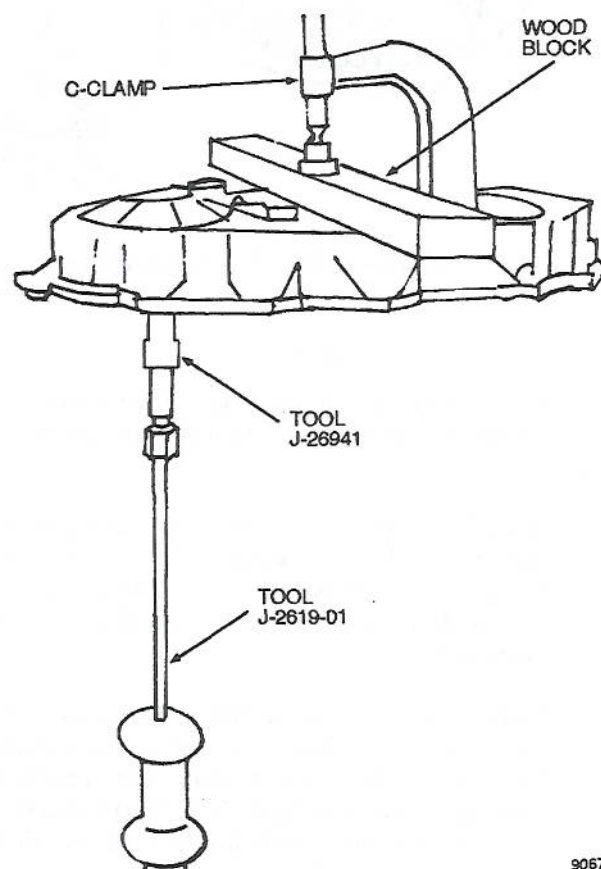


Figure 5-89. Front Output Shaft Rear Bearing Removal

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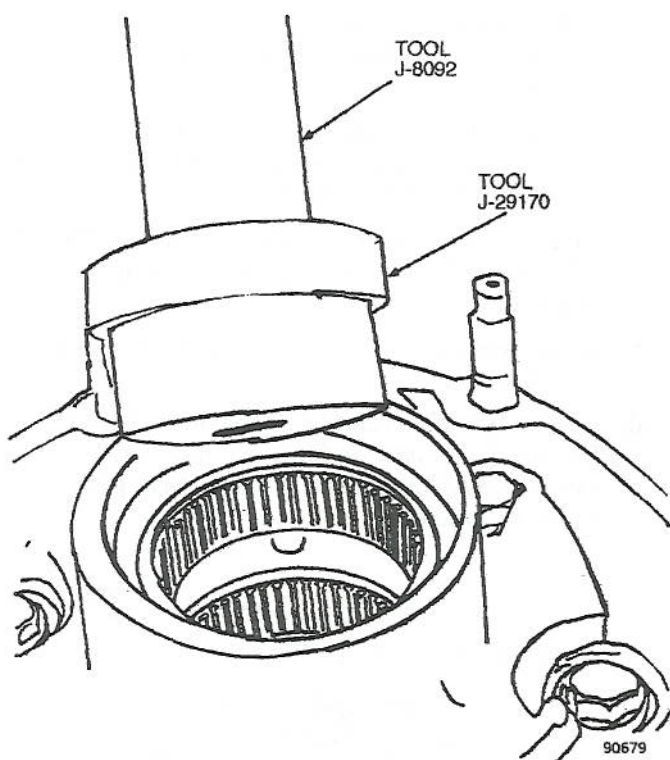
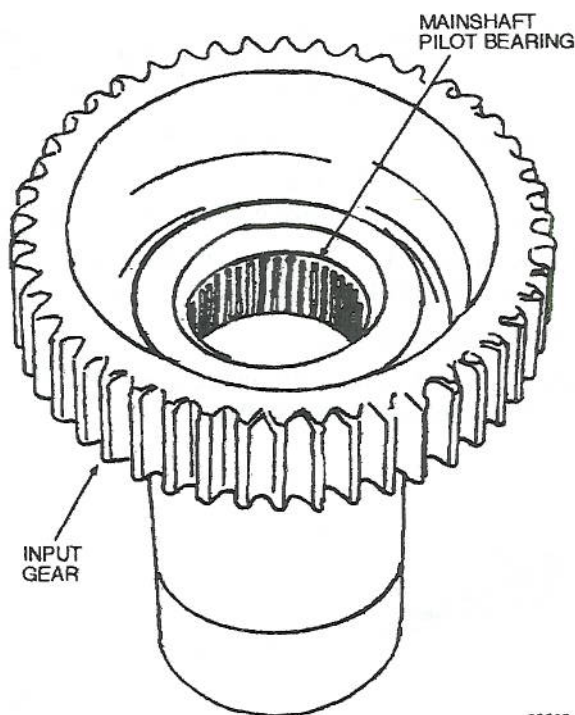


Figure 5-90. Input Gear Bearing Removal



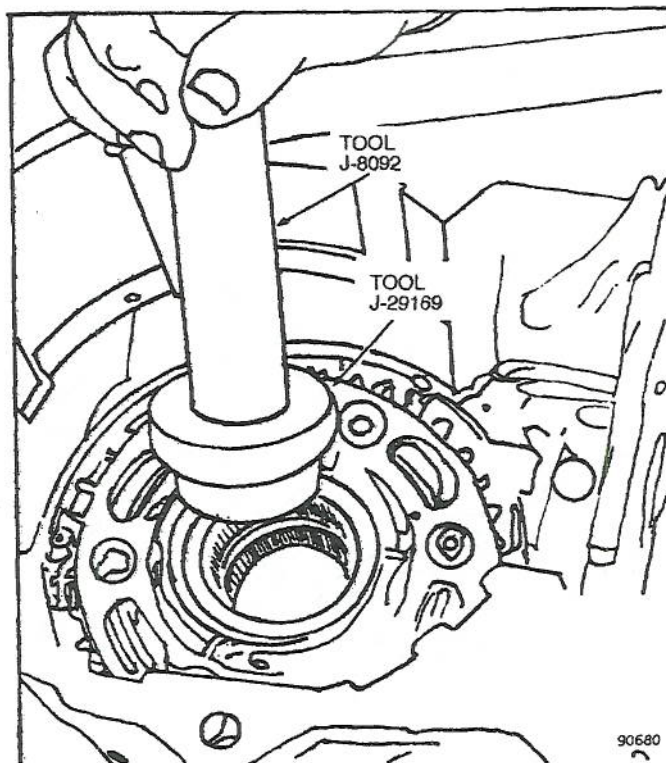
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Figure 5-91. Mainshaft Pilot Bearing Installation

NOTE

Throughout this procedure, rotate the transfer case assembly as necessary to install the gears and shafts.

- (1) Install bearing (11, figure 5-86), using driver handle #J-8092 and installer #J-29174, as shown in figure 5-91. Make sure feed hole is not covered and that bearing (11) is seated flush with bearing bore.
- (2) Install two bearings (8, figure 5-86), one at a time. Use driver handle #J-8092 and installer #J-29169 to install rear bearing first, then front bearing as shown in figure 5-92. Make sure feed holes are not covered and that bearings are flush with case bore surfaces.
- (3) Install bearing (46, figure 5-86), using driver handle #J-8092 and installer #J-29163, as shown in figure 5-93. Make sure oil feed hole is not covered and that bearing is seated flush with edge of case bore.
- (4) Install bearing (40, figure 5-86), using tools #J-8092 and #J-29167, as shown in figure 5-94. Make sure oil feed hole is not covered.



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Figure 5-92. Input Gear Bearing Installation

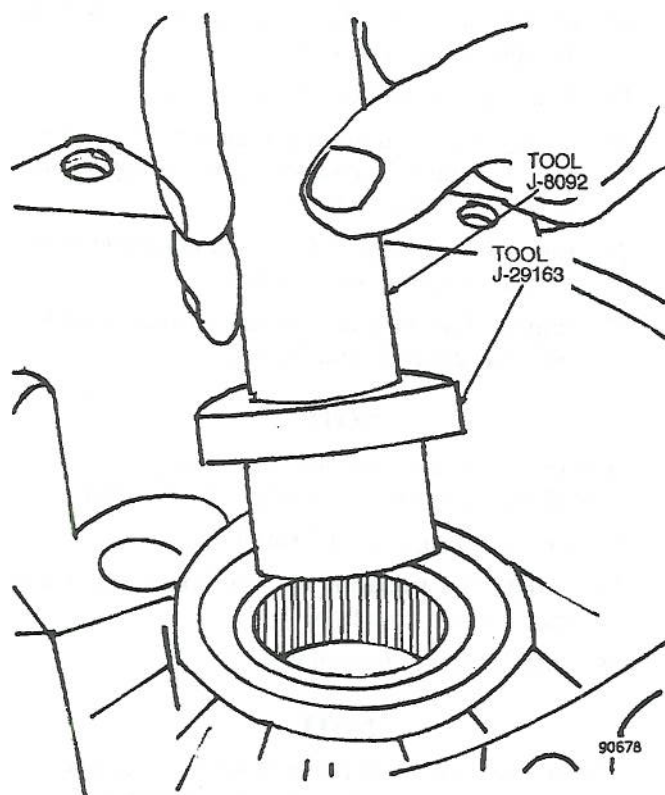


Figure 5-93. Front Output Shaft Rear Bearing Installation

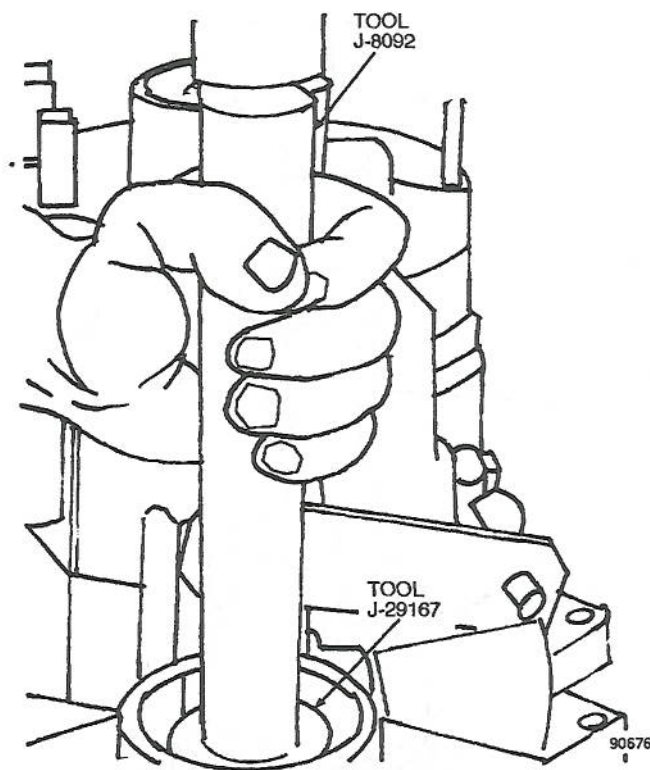


Figure 5-94. Front Output Shaft Front Bearing Installation

- (5) Install bearing (31, figure 5-86), using tool #J-7818, as shown in figure 5-95, so that shielded side of bearing (31) faces interior of case,
- (6) Install retaining ring (30, figure 5-86).
- (7) Install seal (32), using tools #J-8092 and #J-29162, as shown in figure 5-96.

NOTE

Lubricate all remaining components with Dexron II transmission fluid or petroleum jelly, as necessary, during assembly.

- (8) Install roller and retainer (9, figure 5-86) in front case half.
- (9) Install input gear assembly (10).
- (10) Install roller and retainer (19) in input gear assembly (10).
- (11) Install planetary gear assembly (12) over input gear assembly (10). Make sure planetary gear assembly (12) is fully seated and meshed with input gear assembly (10).

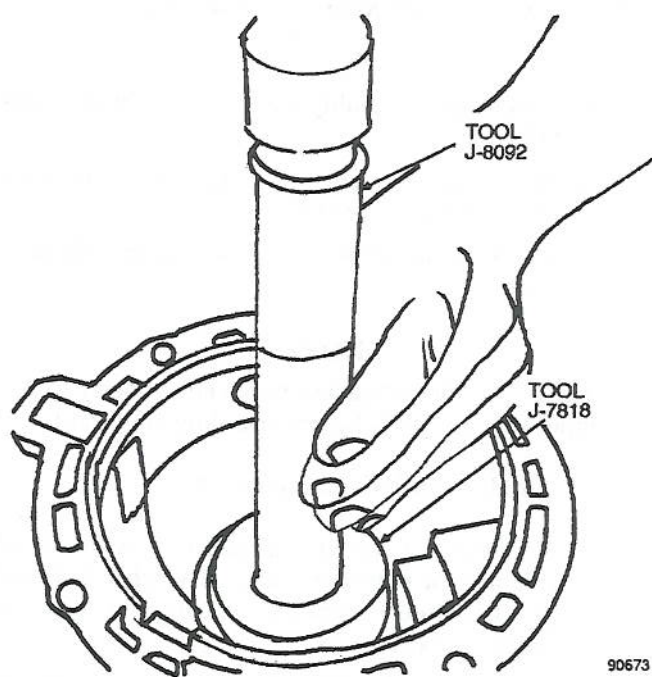


Figure 5-95. Rear Output Bearing Installation

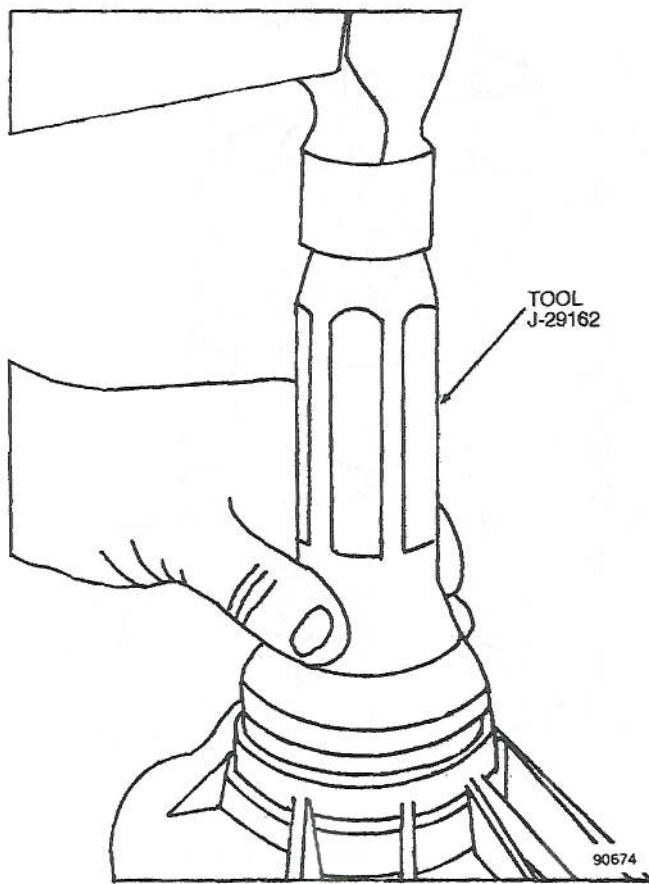


Figure 5-96. Rear Seal Installation

- (12) Install hub assembly (14) and retaining rings (15) and (18).
- (13) Install thrust washer (17), retaining ring (16) and retaining ring (13).
- (14) Refer to paragraph 5-5.3.4 and install shift rail.

NOTE

Make sure thrust bearing is seated properly in input gear assembly before installing mainshaft.

- (15) Install mainshaft assembly (20).
- (16) Coat bore of sprocket carrier (25) with liberal quantity of petroleum jelly (23, table 51), and position one spacer (1) at center of bore of sprocket carrier (25).
- (17) Coat rollers (2) with petroleum jelly and install 60 rollers (2) in each end of bore of sprocket carrier (25).

- (18) Install one spacer (1) in each end of the bore of the sprocket carrier (25).
- (19) Install thrust washer (22) and pin (21).
- (20) Align assembled sprocket carrier (25) and install a mainshaft assembly (20), being careful to avoid displacing rollers (2).
- (21) Refer to paragraph 5-5.3.4 and assemble mode fork, fork spring and bracket.
- (22) Engage fork in gear (23) and install assembly on shift rail and mainshaft (20).

NOTE

If the sprocket carrier has two ring grooves, install the stop ring in the upper groove only.

- (23) Install spring (24) and ring (26).
- (24) Install thrust bearing (41) in front case. Thick race goes in case first.
- (25) Install front output shaft (42).

NOTE

When installing the drive sprocket, the recessed side of the sprocket should face the interior of the case.

- (26) Position sprockets (43) and (27) in chain (44), align sprockets (43) and (27) with shafts (20) and (42) and install sprockets (43) and (27) and chain (44).
- (27) Install thrust washer (3) and retaining ring (4) on sprocket (25).
- (28) Install retaining ring (45).
- (29) Install thrust bearing (47) on front output shaft. Thin race goes on first.
- (30) Install gear set (5) on mainshaft assembly (20). Recessed side of gear set (5) faces downward, toward interior of case.
- (31) Install speedometer gear (6) on mainshaft assembly (20).
- (32) Refer to paragraph 5-5.3.2 and assemble case halves.
- (33) Install packing assembly (28) in pump housing. Apply petroleum jelly (23, table 5-1) to pump housing (29) tabs and install housing (29) in rear retainer (paragraph 55.3.3a).
- (34) Refer to paragraph 5-5.3.3a and install rear retainer.
- (35) Install seal (39).

- (36) Install yoke and slinger assembly (38), washer (37) and nut (36). Tighten nut (36) to torque specified in table 6-2.
- (37) Install yoke (33) with lockwasher (34) and nut (35). Tighten nut (35) to torque specified by table 6-2.
- (38) Refer to paragraph 5-5.3.2 to assemble and install transfer case assembly and transfer case housing group.

5-5.3.4 Transfer Case Shift Forks Group. Refer to figure 5-97, and perform the following steps to overhaul the transfer case shift forks group.

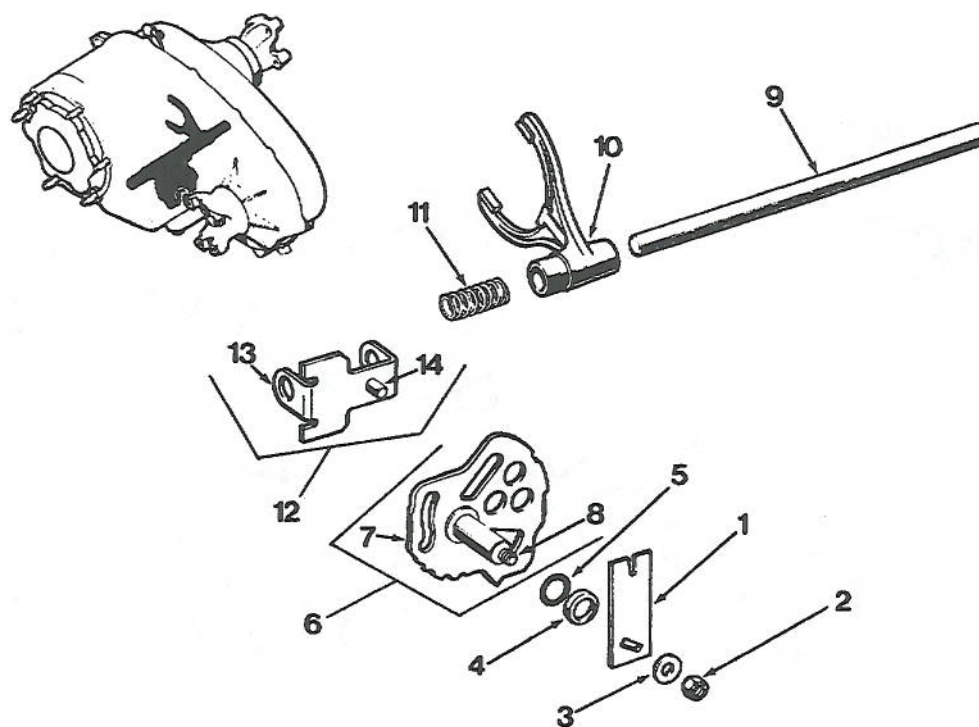
- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the transfer case shift forks group as follows:

- (1) Refer to paragraph 5-5.3.3 and disassemble transfer case gears and shafts up through step (11) of paragraph 5-5.3.3a, removing the sprocket stop ring and mode shift spring.

NOTE

Mode clutch gear should be removed with mode fork spring and bracket.

- (2) Remove mode clutch gear, mode fork (10), rail spring (11) and bracket and pin assembly (12).
- (3) Remove shift rail (9).
- (4) Remove pin (14) from bracket (13).
- (5) Remove self-locking nut (2), washer (3) and plate (1).
- (6) Remove sector and shaft assembly (6) and remove retainer (4) and preformed packing (5).
- (7) Remove shifter (7) from shaft (8).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.



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|----------------------|------------------------------|------------------------------|
| 1. Plate | 6. Sector and Shaft Assembly | 11. Rail Spring |
| 2. Self-Locking Nut | 7. Shifter | 12. Bracket and Pin Assembly |
| 3. Washer | 8. Shouldered Shaft | 13. Bracket |
| 4. Retainer | 9. Shift Rail | 14. Pin |
| 5. Preformed Packing | 10. Mode Fork | |

Figure 5-97. Transfer Case Shift Forks Group

d. Assembly and installation. Assembly and installation is accomplished during the transfer case shift forks group as follows:

- (1) Refer to paragraph 5-5.3.3 and install input oil seal, input bearing, thrust bearing and input gear assembly.
- (2) Install shifter (7) on shaft (8).
- (3) Install preformed packing (5), retainer (4) and sector and shaft assembly (6).
- (4) Install plate (1) with washer (3) and self-locking nut (2). Tighten self-locking nut to torque specified in table 6-2.
- (5) Install pin (14) in bracket (13).
- (6) Refer to paragraph 5-5.3.3 and install planetary gear assembly, hub assembly, retaining rings and planetary thrust washer.

NOTE

The shift rail bore, in the transfer case, must be completely dry and contain no oil or rail may not seat completely.

(7) Install shift rail (9).

(8) Refer to paragraph 5-5.3.3 and install mainshaft assembly, sprocket carrier with needle bearings and spacers, thrust washer and pin.

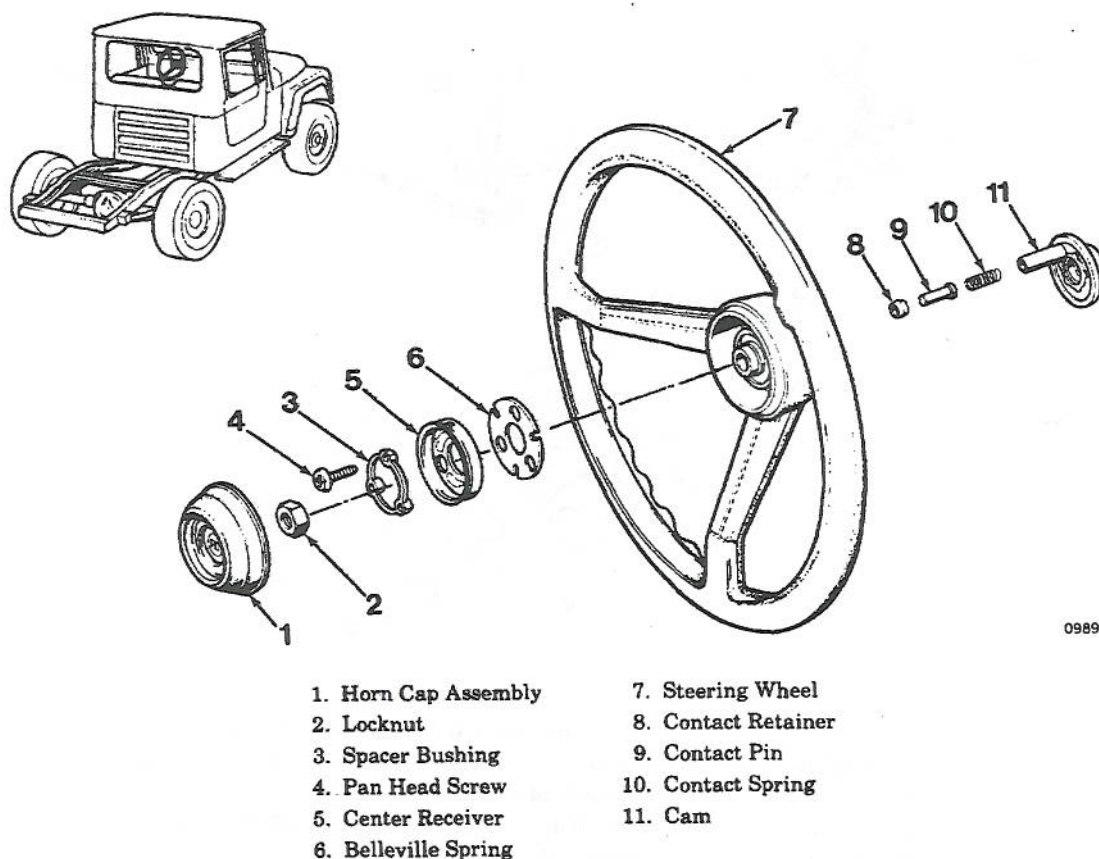
(9) Fit mode fork (10) over mode clutch gear and install mode fork (10), rail spring (11) and bracket and pin assembly (12) on shift rail (9) as mode clutch gear goes on main shaft.

5-5.3.5 Air Compression System. Data for this paragraph will be provided in a subsequent change to this manual.

Figures 5-98, 5-99 and 5-100 will be provided in a subsequent change to this manual.

5-5.4 Steering.

5-5.4.1 Steering Wheel Group. Refer to figure 5-101, and perform the following steps to overhaul the steering wheel group.



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Figure 5-101. Steering Wheel Group

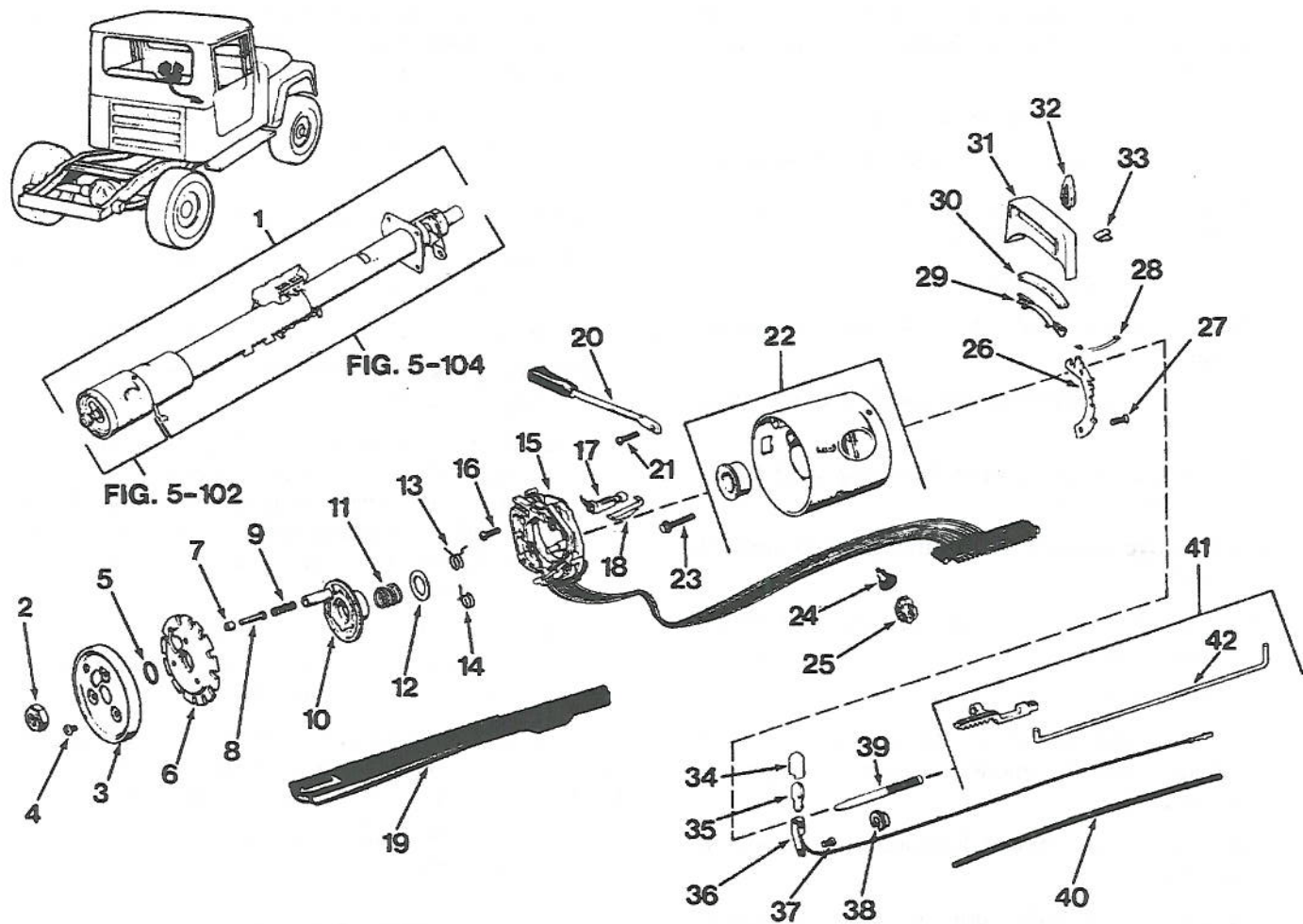
- a. Removal and disassembly. Disassembly is accomplished during removal. Remove steering wheel as follows:
 - (1) Disconnect battery negative cable.
 - (2) Place front wheels in straight ahead position.
 - (3) Remove horn cap assembly (1). Pull cap assembly (1) straight up to remove.
 - (4) Remove locknut (2).
 - (5) Remove pan head screws (4) and spacer bushing (3).
 - (6) Remove center receiver (5) and belleville spring (6).
 - (7) Mark steering wheel and steering shaft for assembly reference.
 - (8) Remove steering wheel using puller tool #J-21232.
 - (9) Remove contact retainer (8), contact pin (9) and contact spring (10).
 - (10) Remove cam (11).
 - b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
 - c. Repair and replacement. Replace all worn or damaged parts.
 - d. Assembly and installation. Assembly is accomplished during installation. Install steering wheel group as follows:
 - (1) Install cam (11).
 - (2) Install contact spring (10), contact pin (9) and contact retainer (8).
 - (3) Align reference marks on steering wheel (7) and steering shaft and install steering wheel (7).
 - (4) Install belleville spring (6) and center receiver (5).
 - (5) Install spacer bushing (3) using pan head screws (4).
 - (6) Install locknut (2) and tighten to torque specified by table 6-2.
 - (7) Install horn cap assembly (1).
- 5-5.4.2 Steering Column Assembly and Upper Housing Group.** Refer to figure 5-102, and perform the following steps to overhaul the steering column assembly and upper housing group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove steering column assembly and upper housing group as follows:
 - (1) Disconnect battery negative cable. Refer to paragraph 5-5.4.3 and remove steering column assembly (1).
 - (2) Cover painted areas of column (1).
 - (3) Refer to paragraph 5-5.4.1 and remove locknut (2) and steering wheel.
 - (4) Remove machine screws (4) and cover (3).
 - (5) Compress shaft lock (6) and unseat retaining ring (5) as follows:
 - (a) Inspect and identify steering shaft nut thread type. Metric shafts have identifying groove in steering wheel locating splines. See figure 5-103 in subparagraph d, Assembly and Installation. American thread shafts do not have this groove.
 - (b) If shaft has American threads, use tool #J-23653 as is to compress shaft lock (6, figure 5-102) and unseat retaining ring (5).
 - (e) If shaft has metric threads, replace compressor tool forcing screw with metric forcing screw #J-23653-4 before installing tool #J-23653 on steering shaft.
 - (6) Remove tool and retaining ring (5). Discard retaining ring (5).

CAUTION

The shaft is free in the column after retainer ring is removed. Do not allow the shaft to fall out of the column.

- (7) Remove shaft lock (6), control cam (10), spring (11) and flat washer (12).
- (8) Remove retainer (7), pin (8) and spring (9).
- (9) Remove hazard warning knob (24) by pressing inward and unthreading knob (24) from column.
- (10) Remove pan head screw (21) and manual control lever (20).
- (11) Unhook turn signal switch assembly (15) wire harness connector from bracket at lower end of steering column.
- (12) Disconnect instrument panel harness connector from turn signal switch harness connector by lifting plastic lock tab on connector and separating connectors.



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|---------------------------------|----------------------------------|------------------------------|
| 1. Steering Column Assy. | 16. Pan Head Screw | 30. Seal |
| 2. Locknut | 17. Switch Assembly | 31. Bezel and Dial |
| 3. Cover | 18. Retaining Clip | 32. Pointer Indicator |
| 4. Machine Screw | 19. Wiring Protector | 33. Gear and Selector Spring |
| 5. Retaining Ring | 20. Manual Control Lever | 34. Lamp Hood |
| 6. Shaft Lock | 21. Pan Head Screw | 35. Lamp |
| 7. Retainer | 22. Service Housing Assembly Kit | 36. Socket Assembly |
| 8. Pin | 23. Tapping Screw | 37. Machine Screw |
| 9. Spring | 24. Hazard Warning Knob | 38. Thrust Washer Bearing |
| 10. Control Cam | 25. Ignition Actuator | 39. Spring Bolt Assembly |
| 11. Spring | 26. Shift Lever Gate | 40. Dial Lamp Protector |
| 12. Flat Washer | 27. Machine Screw | 41. Rack Assembly |
| 13. Cancel Spring | 28. Flat Spring | 42. Actuator Rod |
| 14. Cancel Spring | 29. Bezel Bracket | |
| 15. Turn Signal Switch Assembly | | |

Figure 5-102. Steering Column and Upper Housing Group

- (13) Wrap tape around turn signal switch harness connector to prevent its becoming snagged during removal.
- (14) Remove pan head screws (16) and turn signal switch assembly (15). Pull switch (15) and harness straight up and out of housing. Remove wiring protector (19).
- (15) Remove cancel springs (13) and (14) from turn signal switch assembly (15).
- (16) Remove retaining clip (18) and switch assembly (17).
- (17) Refer to paragraph 5-5.10.25 and remove ignition switch, lock cylinder and ignition switch.
- (18) Remove tapping screws (23).
- (19) Remove service housing assembly kit (22).
- (20) Disengage rod (42) from lock rack portion of rack assembly (41).
- (21) Remove screws attaching shroud to housing (22) and remove housing (22) from shroud.
- (22) Remove wave washer from key release lever pivot and remove key release lever and spring.
- (23) Remove lock rack portion of rack assembly (41) and spring bolt assembly (39).
- (24) Remove flat spring (28).
- (25) Remove ignition actuator (25) through lock cylinder hole in housing (22). Push on block tooth of sector kit (25) with blunt punch to remove.
- (26) Remove steering shaft from column (1).
- (27) Remove spring clip from lower bearing retainer and remove retainer, bearing and adapter.
- (28) Remove machine screw (27) and shift lever gate (26).
- (29) Remove bezel bracket (29), seal (30) and bezel and dial (31).
- (30) Remove pointer indicator (32) and gear and selector spring (33) from bezel and dial (31).
- (31) Remove thrust washer bearing (38).
- (32) Remove machine screw (37) and socket assembly (36).
- (33) Remove lamp hood (34) and lamp (35).
- (34) Remove dial lamp protector (40).

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install steering column assembly and upper housing group as follows:



Use only the specified screws, bolts and nuts when servicing the column, and tighten all fasteners to recommended torque values only to maintain the energy-absorbing (compressing) action of the column. Incorrect length screws or bolts can prevent the column from compressing under impact. The bolts and nuts that attach the column mounting bracket to the column and instrument panel must also be tightened to the proper torque so that the bracket will break away under impact.

- (1) Coat all friction and bearing surfaces with chassis grease (22, table 5-1) before assembly.
- (2) Install dial lamp protector (40) on socket assembly (36) cable.
- (3) Install lamp (35) and lamp hood (34) on socket assembly (36).
- (4) Install socket assembly (36) using machine screw (37).
- (5) Install thrust washer bearing (38).
- (6) Install gear and selector spring (33) and pointer indicator (32) in bezel and dial (31).
- (7) Install bezel bracket (29), seal (30) and bezel and dial (31).
- (8) Install shift lever gate (26) using machine screw (27).
- (9) Install ignition actuator (25) through lock cylinder hole in housing. Use blunt tool to press ignition actuator (25) into shaft.
- (10) Install flat spring (28). Bowed side of spring must bear against lock rack portion of rack assembly (41) when rack assembly (41) is installed.
- (11) Assemble spring bolt assembly (39) and lock rack portion of rack assembly (41).
- (12) Install assembled spring bolt (39) and lock rack (41).

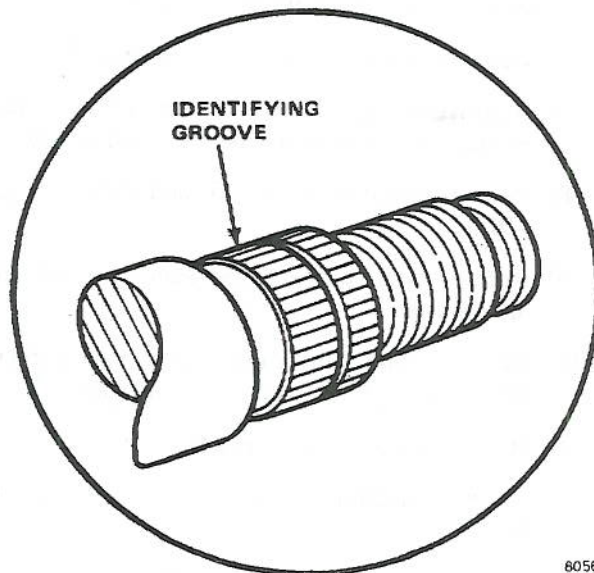
- (13) Install key-release lever return spring over post in housing (22). Insert release lever fingers in slot in lock rack (41) and position hole in lever over threaded hole in housing (22) port. Be sure inner end of spring contacts release lever.
- (14) Raise key-release lever slightly and install end of release lever spring between lever and housing base.
- (15) Coat wave washer with chassis grease and install washer on post and over release lever.
- (16) Position shroud on housing (22) and install attaching screws. Tighten screws to torque specified by table 6-2. Do not displace release lever wave washer when assembling shroud and housing (22).
- (17) Install actuator rod (42) in lock rack portion of rack assembly (41). Insert short hooked end of rod (42) in lock rack.
- (18) Install assembled shroud and housing (22) on column (1) and install attaching screws (23). Tighten screws to torque specified by table 6-2.
- (19) Refer to paragraph 5-5.10.25 and install ignition switch cylinder and ignition switch.
- (20) Install lower bearing, bearing adapter, retainer, and retaining ring in lower end of column.
- (21) Install steering shaft through lower end of column and into upper bearing in housing (22).
- (22) Install switch assembly (17) and retaining clip (18).
- (23) Install cancel springs (13) and (14) in turn signal switch assembly (15).
- (24) Install turn signal switch assembly (15).
- (25) Fold turn signal wiring against connector and feed connector through housing (22). Connect wiring connector.
- (26) Align turn signal switch assembly (15) in housing (22) and secure switch assembly (15) using pan head screws (16). Tighten screws to torque specified by table 6-2.
- (27) Install wiring protector (19).
- (28) Install manual control lever (20) using pan head screws (21). Tighten screw to torque specified by table 6-2.
- (29) Install flat washer (12), spring (11) and control cam (10) on steering shaft.

- (30) Place manual control lever (20) in neutral position and install hazard warning knob (24).
- (31) Install spring (9) and pin (8) in control cam (10).
- (32) Position shaft lock (6) on steering shaft.
- (33) Install replacement retaining ring (5) on sleeve of compressor tool #J-23653 and install tool on steering shaft.

CAUTION

Identify the steering shaft nut thread type before using the compressor tool. If the shaft has American threads, use the compressor tool as is. However, if the shaft has metric threads (figure 5-103), replace the compressor tool forcing screw with metric forcing screw #J-23653-4 before using the tool.

- (34) Compress shaft lock (6, figure 5-102) and install retaining ring (5) in steering shaft groove.
- (35) Remove compressor tool.
- (36) Install retainer (7) on end pin (8) protruding from shaft lock (6).
- (37) Install lock plate cover (3) using machine screws (4).



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Figure 5-103. Metric Steering Shaft Identification

CAUTION

Some steering shafts have metric size steering wheel nut threads. If a replacement locknut is being installed, identify the shaft thread type before installation. Metric shafts have an identifying groove in the steering wheel locating splines (figure 5-103). American thread shafts do not have this groove.

- (38) Refer to paragraph 5-5.4.1 and install steering wheel and locknut (2, figure 5-102). Tighten locknut to torque specified by table 6-2.
- (39) Refer to paragraph 5-5.4.3 and install steering column assembly (1).
- (40) Connect battery negative cable.

5-5.4.3 Steering Column Lower Housing and Shafts Group. Refer to figure 5-104, and perform the following steps to overhaul the steering column housing and shafts group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove steering column lower housing and shafts group as follows:
 - (1) Disconnect battery negative cable.

CAUTION

Do not attempt to separate the lower shaft and steering column at this time. If separated, the plastic connector injected into the lower shaft could be damaged.

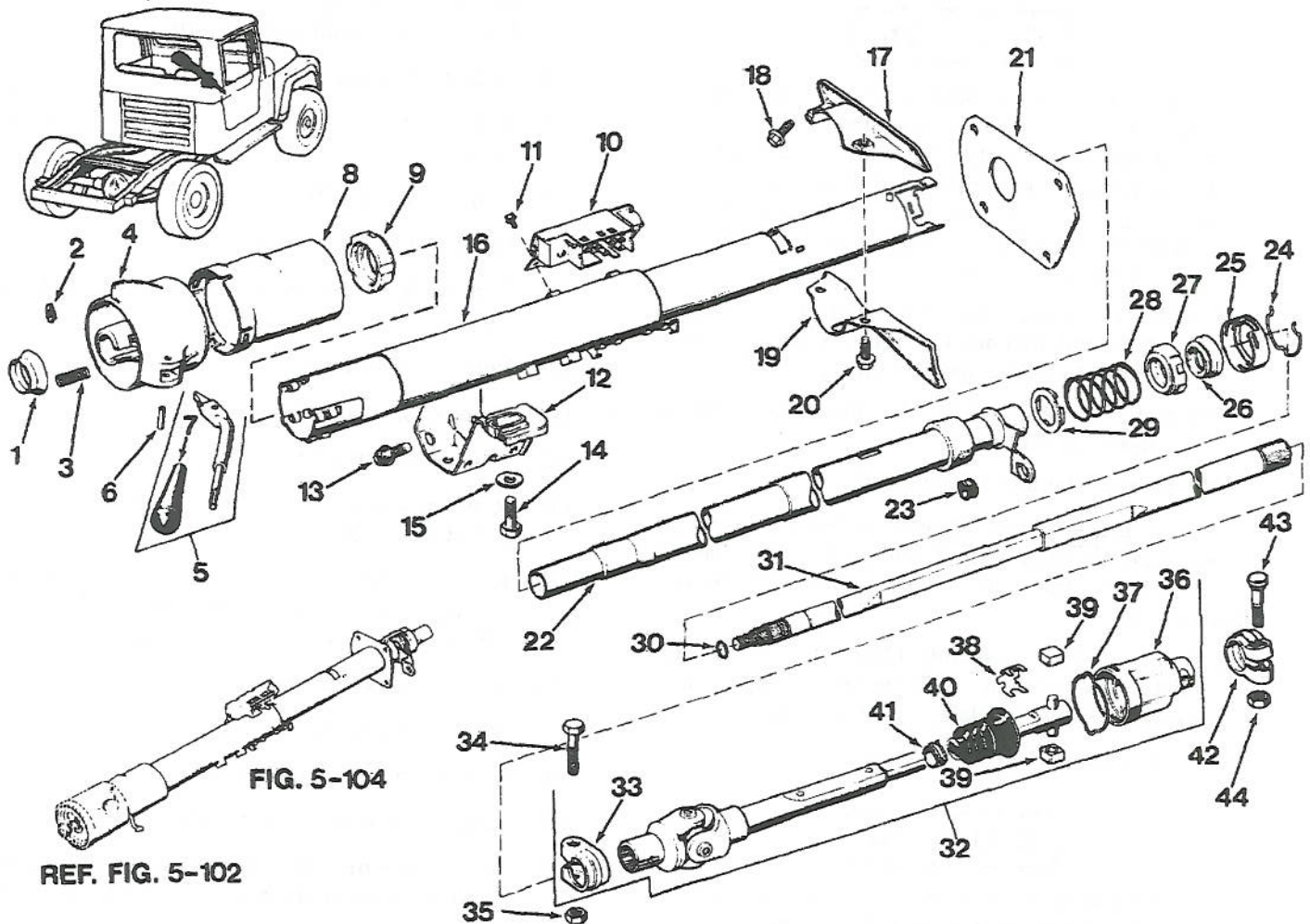
- (2) Remove steering column jacket assembly (16) from instrument panel bezel.
- (3) Remove capscrews (14) and flat washers (15) attaching jacket assembly (16) to instrument panel.
- (4) Remove capscrews (13) attaching bracket assembly (12) to jacket assembly (16), and remove bracket assembly (12).

CAUTION

To avoid damaging the mounting bracket break-away capsules, store the bracket in a safe place until service operations are completed.

- (5) Remove capscrews (18) and (20) and plates (17) and (19).
- (6) Disconnect wiring harness at ignition switch (10).

- (7) Refer to paragraph 5-5.4.2 and remove upper housing and retaining ring (30).
- (8) Remove housing cup (1).
- (9) Remove pointer indicator (2) from bezel and dial.
- (10) Remove spring (3).
- (11) Remove lever bowl (4).
- (12) Remove hinge pin (6) and manual control lever (5).
- (13) Remove lever knob (7).
- (14) Remove shroud (8).
- (15) Remove bearing (9).
- (16) Remove screw and washers (11) and ignition switch assembly (10).
- (17) Remove clip (24) and retainer (25); remove bearing assembly (26), shift adapter (27), spring (28) and thrust washer bearing (29).
- (18) Remove jacket assembly (16).
- (19) Remove seal (21).
- (20) Remove tube assembly (22).
- (21) Remove grommet (23) from tube assembly (22).
- (22) Loosen hex nut (35) and capscrew (34) and remove steering shaft assembly (31) from clamp (33).
- (23) Remove clamp (33) from lower shaft and remove hex nut (35) and capscrew (34) from clamp (33).
- (24) Remove hex nut (44), capscrew (43), clamp (42) and lower shaft (32).
- (25) Remove retaining ring (37) and coupling (36).
- (26) Remove bearings (39) and spring (38).
- (27) Loosen retaining clamp (41) and remove seal (40).
- (28) Remove retaining clamp (41).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install steering column lower housing and shafts group as follows:
 - (7) Refer to paragraph 5-5.4.2 and remove upper housing and retaining ring (30).
 - (8) Remove housing cup (1).
 - (9) Remove pointer indicator (2) from bezel and dial.
 - (10) Remove spring (3).
 - (11) Remove lever bowl (4).
 - (12) Remove hinge pin (6) and manual control lever (5).
 - (13) Remove lever knob (7).
 - (14) Remove shroud (8).
 - (15) Remove bearing (9).
 - (16) Remove screw and washers (11) and ignition switch assembly (10).
 - (17) Remove clip (24) and retainer (25); remove bearing assembly (26), shift adapter (27), spring (28) and thrust washer bearing (29).
 - (18) Remove jacket assembly (16).
 - (19) Remove seal (21).
 - (20) Remove tube assembly (22).
 - (21) Remove grommet (23) from tube assembly (22).
 - (22) Loosen hex nut (35) and capscrew (34) and remove steering shaft assembly (31) from clamp (33).
 - (23) Remove clamp (33) from lower shaft and remove hex nut (35) and capscrew (34) from clamp (33).
 - (24) Remove hex nut (44), capscrew (43), clamp (42) and lower shaft (32).
 - (25) Remove retaining ring (37) and coupling (36).
 - (26) Remove bearings (39) and spring (38).
 - (27) Loosen retaining clamp (41) and remove seal (40).
 - (28) Remove retaining clamp (41).



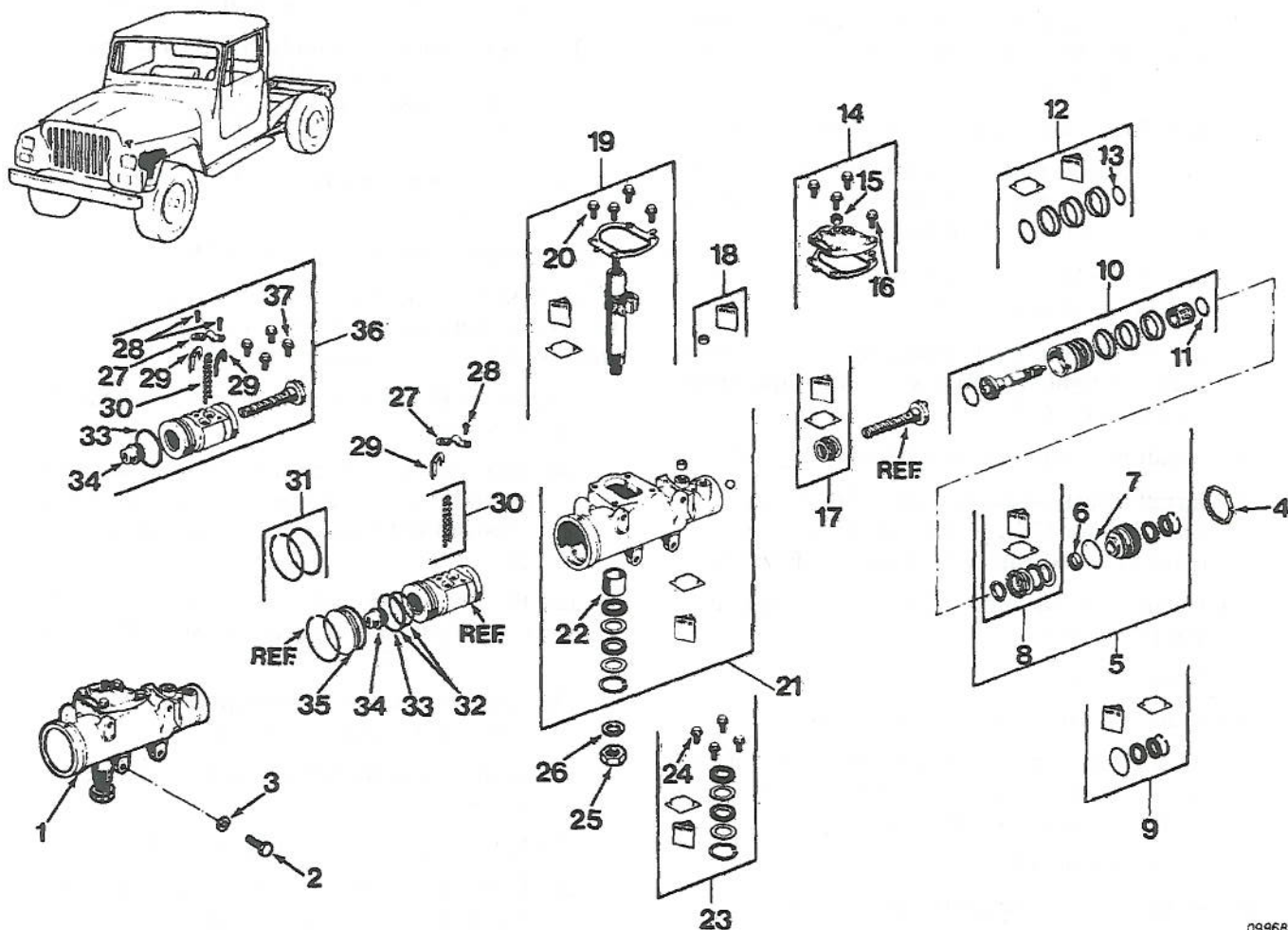
1. Housing Cup
2. Pointer Indicator
3. Spring
4. Lever Bowl
5. Manual Control Lever
6. Hinge Pin
7. Lever Knob
8. Shroud
9. Bearing
10. Ignition Switch Assembly
11. Screw and Washer
12. Bracket Assembly
13. Hex Screw
14. Cap screw
15. Flat Washer

16. Steering Column Jacket Assembly
17. Plate
18. Cap screw
19. Plate
20. Cap screw
21. Seal
22. Tube Assembly
23. Grommet
24. Clip
25. Retainer
26. Bearing Assembly
27. Shift Adapter
28. Spring
29. Thrust Washer Bearing
30. Retaining Ring

31. Steering Shaft Assembly
32. Lower Shaft
33. Clamp
34. Cap screw
35. Hex Nut
36. Coupling
37. Retaining Ring
38. Spring
39. Bearing
40. Seal
41. Retaining Clamp
42. Clamp
43. Cap screw
44. Lock Hex Nut

Figure 5-104. Steering Column Lower Housing and Shafts Group

- (1) Place retaining clamp (41) and seal (40) on lower shaft (32). Do not tighten clamp (41) yet.
 - (2) Install spring (38) and bearings (39) and position seal (40) over bearings (39). Tighten retainer clamp (41).
 - (3) Install retainer ring (37) and coupling (36).
 - (4) Install lower shaft (32) using clamp (42), cap-screw (43) and hex nut (44). Tighten cap screw (43) to torque specified by table 6-2.
 - (5) Install clamp (33), cap screw (34) and hex nut (35) on lower shaft (32).
 - (6) Install steering shaft assembly (31) in lower shaft and tighten cap screw (34) to torque specified by table 6-2.
 - (7) Install grommet (23) in tube assembly (22).
 - (8) Install thrust washer bearing (29), spring (28), shift adapter (27), bearing assembly (26), retainer (25) and clip (24) on tube assembly (22).
 - (9) Install tube assembly (22) over steering shaft assembly (31).
 - (10) Install seal (21).
 - (11) Install steering column jacket assembly (16).
 - (12) Install ignition switch assembly (10) using screws and washers (11). Tighten screws to torque specified in table 6-2.
 - (13) Install bearing (9).
 - (14) Install shroud over jacket assembly (16).
 - (15) Install lever knob (7) on manual control lever (5).
 - (16) Install manual control lever (5) on lever bowl (4) using hinge pin (6).
 - (17) Install lever bowl (4) on jacket assembly (16).
 - (18) Install spring (3).
 - (19) Install pointer indicator (2) in bezel and dial.
 - (20) Install housing cup (1).
 - (21) Refer to paragraph 5-5.4.2 and install upper housing and retaining ring (30).
 - (22) Connect wiring harness at ignition switch (10).
 - (23) Install plates (17) and (19) using cap screws (18) and (20). Tighten cap screws (18) and (20) to torque specified by table 6-2.
 - (24) Install bracket assembly (12) on jacket assembly (16) using cap screws (13). Tighten cap screws to torque prescribed by table 6-2.
 - (25) Install bracket assembly (12) on instrument panel using cap screws (14) and flat washers (15). Tighten cap screws to torque specified by table 6-2.
 - (26) Install jacket assembly (16) to instrument panel bezel.
 - (27) Connect battery negative cable.
- 5-5.4.4 Steering Gear Components Group.** Refer to figure 5-105, and perform the following steps to overhaul the steering gear components group.
- a. Removal. Remove steering gear components group as follows:
 - (1) Disconnect pressure and return hoses at gear assembly (1). Keep hoses raised to avoid excessive fluid loss and cap hoses to prevent dirt entry.
 - (2) Remove clamp bolt and nut attaching flexible coupling to steering gear stub shaft, part of valve assembly (10).
 - (3) Paint alignment marks on pitman shaft and pitman arm for assembly reference.
 - (4) Remove and discard hex nut (25) and lockwasher (26).
 - (5) Remove pitman arm using tool #J-6632.
 - (6) Remove special cap screws (2) and special washers (3) and remove gear assembly (1).
 - b. Disassembly. Disassemble steering gear components group as follows:
 - (1) Drain fluid from gear assembly (1).
 - (2) Cap all openings in exterior of gear assembly (1) and clean exterior thoroughly.
 - (3) Mount gear assembly (1) in vise so pitman shaft (19) points downward. Clamp unmachined housing base portion of gear assembly (1) in vise only.
 - (4) Rotate end plug retaining ring component of steering parts kit (31) until one end of ring is aligned with hole in side of gear assembly housing kit (21). Unseat ring using punch inserted through hole in gear assembly housing kit (21) and remove retaining ring using screwdriver.



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|------------------------|-------------------------------|-------------------------|
| 1. Gear Assembly | 13. Seal | 26. Lockwasher |
| 2. Special Capscrew | 14. Cover Parts Kit | 27. Retaining Strap |
| 3. Special Washer | 15. Self-Locking Nut | 28. Screw and Washer |
| 4. Locknut | 16. Machine Bolt | 29. Ball Return Guide |
| 5. Plug Assembly Kit | 17. Bearing Assembly | 30. Steering Parts Kit |
| 6. Bearing | 18. Check Valve Kit | 31. Steering Parts Kit |
| 7. Seal | 19. Steering Shaft Assembly | 32. Steering Parts Kit |
| 8. Steering Parts Kit | 20. Capscrew | 33. Piston Ring |
| 9. Seal Kit | 21. Gear Housing Assembly Kit | 34. End Plug |
| 10. Valve Assembly | 22. Roller Needle Bearing | 35. End Plug |
| 11. Seal | 23. Seal | 36. Rack-Piston-Nut Kit |
| 12. Steering Parts Kit | 24. Machine Bolt | 37. Machine Bolt |
| | 25. Hex Nut | |

Figure 5-105. Steering Gear Components Group

- (5) Remove end plug (35). Install 12-point deep socket and ratchet handle on stub shaft. Slowly rotate shaft counterclockwise until rack piston component of rack-piston-nut kit (36) forces end plug (35) out of gear assembly housing kit (21).

CAUTION

Do not rotate the stub shaft any farther than necessary or the ball bearings will drop out of the rack piston circuits. This causes the rack piston and pitman shaft sector teeth to disengage, preventing removal. If disengagement should occur, remove the side cover and pitman shaft and reengage the teeth.

- (6) Remove seal component of end plug seal kit (31).
- (7) Turn stub shaft 1/2 turn clockwise.
- (8) Unseat rack piston end plug (34) by tapping.

CAUTION

Do not attempt to remove the rack piston end plug until it has been unseated as the plug could break.

- (9) Remove rack piston end plug (34).
- (10) Remove and discard self-locking nut (15).

NOTE

Self-locking nut has left hand threads.

- (11) Remove machine bolt (16) and capscrew (20) and remove cover parts kit (14) from adjuster screw by turning screw clockwise.
- (12) Rotate stub shaft until steering shaft (19) sector teeth are centered in gear assembly housing (21).
- (13) Remove steering shaft (19) from gear assembly housing (21) by tapping threaded end of shaft.

NOTE

Do not remove or disassemble any of the pitman shaft component parts. The shaft and component parts are serviced as an assembly only.

- (14) Remove rack piston from gear assembly housing (21) as follows:
 - (a) Insert arbor tool #J-7539-01 or #J-21552 into rack piston (36) until tool contacts end of wormshaft.

- (b) Hold arbor tool tightly against wormshaft and turn stub shaft counterclockwise to force rack piston (36) onto arbor tool.
 - (c) Remove rack piston (36) and arbor tool as assembly.
- (15) Remove adjuster plug locknut (4).
 - (16) Remove adjuster plug assembly kit (5).
 - (17) Remove steering parts kit (8).
 - (18) Remove seal kit (9).
 - (19) Remove bearing (6) using tool #J-6221. Discard bearings after removal.
 - (20) Remove valve assembly (10) by grasping shaft and pulling outward.
 - (21) Remove and discard stub shaft seal (11).
 - (22) Hold valve body in both hands with stub shaft pointing downward. Tap end of stub shaft lightly against wood block until shaft cap is free of valve body.
 - (23) Pull stub shaft outward until shaft clears valve body by approximately 1/4 inch.
 - (24) Press spool valve locating pin inward and carefully remove stub shaft from valve body and spool valve.
 - (25) Remove spool valve from valve body using a push and turn motion. If spool valve becomes cocked, carefully realign valve and try removal again. Do not force spool valve out.
 - (26) Remove and discard seal (13).
 - (27) Cut and remove steering parts kit (12).
 - (28) Remove wormshaft and bearing assembly (17) from rack-piston-nut kit (36).
 - (29) Remove and discard rack piston ring (33) and steering parts seal kit (32).
 - (30) Remove screws and washers (28) and retaining strap (27).
 - (31) Place rack piston on clean cloth and remove return guide (29) and steering parts kit (30).
 - (32) Remove machine bolts (37).
 - (33) Remove check valve kit (18).
 - (34) Remove machine bolts (24).
 - (35) Remove retaining ring component of seal (23) using snap ring pliers #J-4245.
 - (36) Remove washer, backup washer, double lip seal, backup washer and single lip seal, all of which are contained in seal (23).

(37) Remove needle bearing (22) using tools #J-8092 and #J-21551.

(38) Discard all seals (23) and needle bearing (22).

c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition perform the following steps:

- (1) Inspect check valve (18) to see if it is scored, chipped, cracked or distorted.
- (2) Inspect housing ball plug for leaking.
- (3) Inspect adjuster plug (5) threads for damage.
- (4) Inspect spool valve-to-valve body (10) fit. If fit is loose, entire valve assembly (10) must be replaced.
- (5) Inspect torsion bar on spool valve (10) to see if it is loose or broken. If damaged, it must be replaced.
- (6) Inspect valve body-to-wormshaft notch in valve body (10) skirt for damage or excessive wear. Valve assembly (10) must be replaced if notch is worn or damaged.

d. Repair and replacement. Replace all worn or damaged parts. In addition, perform the following steps.

- (1) If housing ball plug leaks, reseal plug using blunt punch.

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi and goggles must be worn.

- (2) Spray ball area with Loctite Solvent 7559 and dry with compressed air.
- (3) Cover ball area with Loctite Sealant 290 and let stand for 2 hours before installing or assembling gear.

e. Assembly. Assemble steering gear components group as follows:

- (1) Lubricate gear housing and all replacement bearings and seals with power steering fluid.
- (2) Install roller needle bearing (22) using tools #J-8092 and #J-21553 to a depth of approximately 1/32 inch below shoulder in housing bore.

- (3) Install single lip seal and backup washer. Seat washer and seal components of seal (23) using tool #J-21553. Install seal and washer using tool #J-21553. Install seal and washer only far enough to provide clearance for next seal and washer, washer and retaining ring and to provide small clearance between seals.

CAUTION

Do not bottom seal against housing counter-bore.

- (4) Install double lip seal and backup washer, both of which are components of seal (23).
- (5) Install washer component of seal (23).
- (6) Install retaining ring component of seal (23) using snap ring pliers #J-4245.
- (7) Install machine bolts (24).
- (8) Install replacement check valve spring in pressure port of gear housing assembly (21). Be sure spring is seated in pressure port counterbore and large end of spring faces downward.
- (9) Install replacement check valve (18) over spring so valve tongs face downward. Be sure valve is centered on small end of spring.
- (10) Test check valve (18) operation by lightly pressing valve downward with pencil. Valve should reseal itself when pencil pressure is released.
- (11) Lubricate all rack-piston-nut kit components (36) with power steering fluid.
- (12) Install rack piston ring (33) and steering parts kit (32) in ring groove of rack piston.
- (13) Install wormshaft in rack piston.
- (14) Align ball return guide (29) holes with wormshaft grooves.
- (15) Alternately install 18 black and silver ball bearings from the steering parts kit (30) in rack piston bearing circuit hole adjacent to seal ring, a component of steering parts kit (32). Rotate wormshaft slowly in counterclockwise direction when installing bearings and press each bearing downward to make room for following bearing.

NOTE

The wormshaft will back out of the rack piston when rotated during bearing installation. Do not allow the wormshaft to back completely out of the rack piston.

- (16) Fill one ball return guide (29) half with petroleum jelly (21, table 5-1) and install 6 remaining ball bearings in guide (29). Be sure bearings in guide (29) are in sequence with bearings in rack piston and that a total of 24 ball bearings are installed.
- (17) Assemble both ball return guide halves (29) and insert guides in rack piston. Guides should fit loosely.
- (18) Position retaining strap (27) over guides and install using screws and washers (28). Tighten screws (28) to torque specified by table 6-2.
- (19) Insert arbor tool #J-21552 into rack piston until it contacts wormshaft.
- (20) Apply steady pressure against arbor tool to maintain contact with wormshaft and back wormshaft out of rack piston.

NOTE

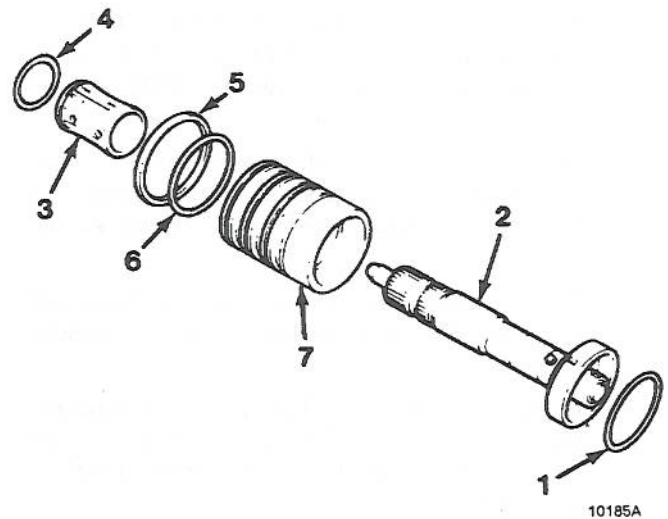
Do not allow the arbor tool and wormshaft to separate during wormshaft removal. The ball bearings could drop out of their circuits and fall inside the rack piston making another disassembly/assembly necessary.

- (21) Position assembled rack piston and arbor tool on end and support assembly on wood blocks until ready to install in gear housing assembly (21).
- (22) Lubricate valve assembly (10) components shown in figure 5-106 with power steering fluid.
- (23) Install replacement backup rings (6, figure 5-106) in seal ring grooves on valve body (7).
- (24) Install replacement seal rings (5) over backup rings (6). Take care to avoid damaging seal rings (5) during installation.

NOTE

The seal rings may appear to be distorted after installation. However, the heat generated by power steering fluid during normal operation will straighten them.

- (25) Lubricate preformed packing (4) and install on spool valve (3).



- | | |
|----------------------|---------------------------|
| 1. Preformed Packing | 5. Replacement Seal Rings |
| 2. Stub Shaft | 6. Backup Rings |
| 3. Spool Valve | 7. Valve Body |
| 4. Preformed Packing | |

Figure 5-106. Valve Assembly Components

- (26) Insert spool valve (3) in valve body. Do not attempt to force spool valve (3) into place.
- (27) Push spool valve (3) through valve body (7) until spool valve locating pinhole is visible at opposite end of valve body (7) and spool valve (3) is flush with notched end of valve body (7).
- (28) Install stub shaft (2) in spool valve (3) and valve body (7). Be sure stub shaft locating pin is aligned with spool valve locating hole.
- (29) Align notch in stub shaft cap with stub shaft locating pin in valve body (7) and press stub shaft (2) and spool valve (3) into valve body.

CAUTION

Before installing the assembled valve body in the gear housing, be sure the valve body stub shaft locating pin is fully engaged in the stub shaft cap notch.

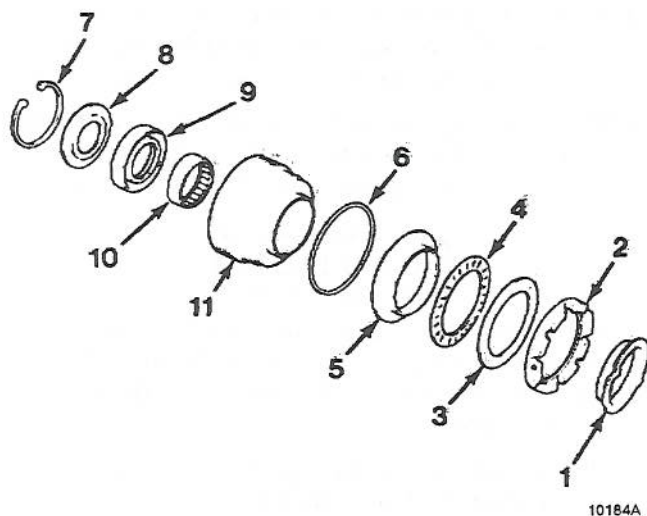
- (30) Lubricate preformed packing (1) with power steering fluid and install in valve body (7).

CAUTION

Do not allow the stub shaft to disengage from the valve body pin. If disengagement occurs, the spool valve will extend too far into the valve body, allowing the preformed packing to expand into the valve body grooves and preventing valve withdrawal.

- (31) If disengagement occurs, attempt to remove the valve using a pull and turn motion. If this fails, perform steps (32), (33) and (34). If the valve is removed, go to step (35).
- (32) First be sure the spool valve is free to rotate, then place the valve body on a flat surface with the notched end of the valve body facing upward.
- (33) Tap the spool valve with a wood or plastic rod until the preformed packing is cut and remove the valve.
- (34) Replace the preformed packing and reassemble the valve body. Be sure all pieces of the cut preformed packing are removed before assembly.
- (35) Lubricate dust seal preformed packing (8, figure 5-107) with petroleum jelly (21, table 5-1). Lubricate all other components shown in figure 5-107 with power steering fluid.
- (36) Position needle bearing assembly (10) on tool #J-6221 so bearing manufacturers identification number is facing tool.
- (37) Install needle bearing assembly (10) in adjuster plug until bearing (10) is flush with bottom surface of stub shaft seal counterbore.

- (38) Install stub shaft seal in adjuster plug deep enough to provide clearance for dust seal and retaining ring.
- (39) Install dust seal (8) and oil seal (9) in adjuster plug (11). Rubber face of seal must face away from plug (outward).
- (40) Install retaining ring using snap ring pliers #J-4245.
- (41) Install preformed packing (6) in adjuster plug ring groove.
- (42) Install large thrust washer (5), upper thrust bearing (4), small thrust washer (3) and spacer (2) in adjuster plug (11).
- (43) Install retainer (1) in adjuster plug (11).
- (44) Mount gear assembly (1, figure 5-105) in vise. Clamp unmachined base portion of housing in vise only.
- (45) Lubricate all components with power steering fluid.
- (46) Install bearing assembly (17) on wormshaft. Coned sides of races must face rack piston when installed.
- (47) Insert wormshaft into valve body. Rotate wormshaft until drive lugs engage in stub shaft cap and wormshaft locating pin engages in valve body notch.
- (48) Install assembled valve assembly (10) in gear housing assembly (21). Be sure wormshaft locating pin is still fully engaged in valve body notch before installing.



- | | |
|-------------------------|-----------------------------|
| 1. Retainer | 7. Retaining Ring |
| 2. Spacer | 8. Dust Seal |
| 3. Small Thrust Washer | 9. Oil Seal |
| 4. Upper Thrust Bearing | 10. Needle Bearing Assembly |
| 5. Large Thrust Washer | 11. Adjuster Plug |
| 6. Preformed Packing | |

CAUTION

Do not press against the stub shaft to install the valve body and wormshaft. This could cause the stub shaft to disengage from the valve body, allowing the spool valve preformed packing to slip into the valve body oil grooves. Perform installation by pressing directly on the valve body with the fingertips only (figure 5-108). In addition, be sure the valve body is properly seated before installing the adjuster plug. When the valve body is seated correctly, the fluid return port in the gear housing will be fully visible (figure 5-109). If the port is not visible, the valve body and wormshaft are misaligned or the thrust bearing and races are improperly installed.

Figure 5-107. Adjuster Plug Components

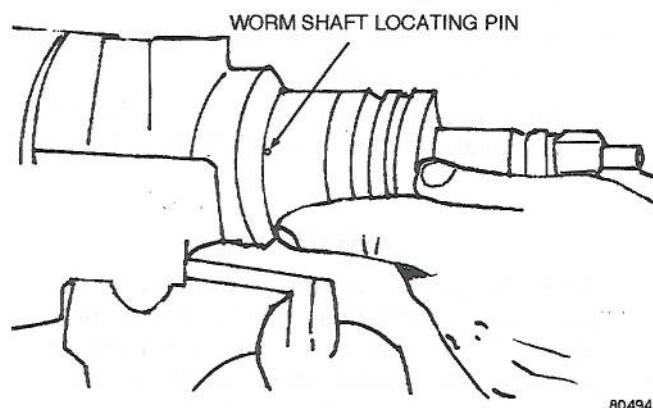


Figure 5-108. Valve Body - Wormshaft Installation

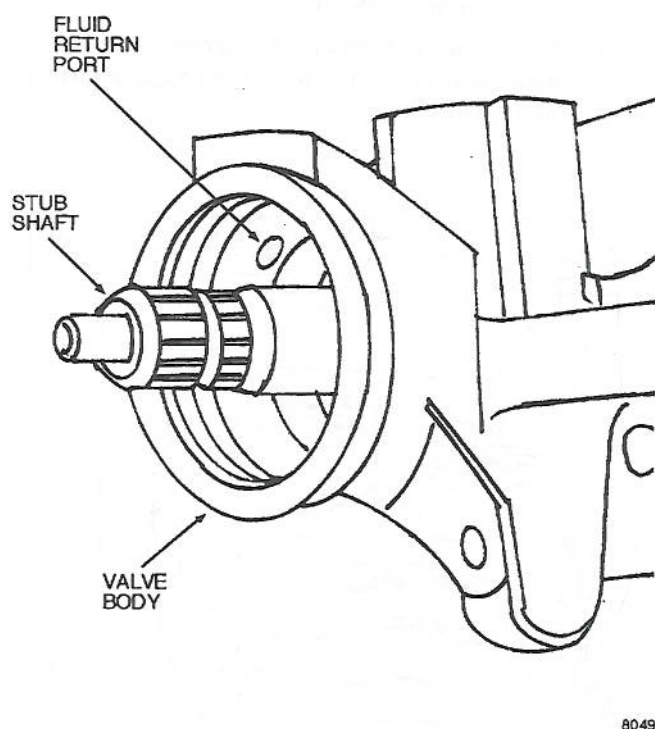


Figure 5-109. Seating Valve Body

- (49) Install rack-piston-nut kit (36, figure 5-105) in gear housing assembly (21). Be sure wormshaft remains engaged with stub shaft. Do not damage rack piston ring (33) during installation. Install machine bolts (37).

- (50) Make sure arbor tool is on rack piston. Remove arbor tool when rack piston seal ring (33) is inside housing (21).
- (51) Rotate stub shaft until center tooth groove in rack piston is aligned with center of steering shaft (19).
- (52) Install side cover gasket on side cover. Be sure gasket rubber seal is seated in cover groove.
- (53) Install steering shaft (19) in housing (21) and mesh center sector tooth of shaft (19) with center tooth groove in rack piston.
- (54) Align side cover and gasket, components of cover parts kit (14), on housing (21) and install capscrews (20). Tighten capscrews to torque specified by table 6-2.
- (55) Thread self-locking nut (15) halfway onto machine bolt (16). Use hex wrench to prevent machine bolt (16) from turning while installing self-locking nut (15).
- (56) Install end plug (34) in rack piston and tighten plug (34) to torque specified by table 6-2.

NOTE

The lash nut has left hand threads.

- (57) Lubricate steering parts kit (31) with (21, table 5-1) petroleum jelly.
- (58) Install end plug (35) and seat end plug (35) against steering parts kit (31). If necessary, tap end plug (35) to seat it. Do not displace steering parts kit (31) during installation.
- (59) Install end plug retainer ring, a component of steering parts kit (31). Position ring end gap at distance specified by table 6-2.

NOTE

The steering gear requires two adjustments; wormshaft bearing preload and steering shaft overcenter drag torque.

Wormshaft bearing preload is controlled by the amount of compression force exerted on the conical wormshaft thrust bearing races by the adjuster plug.

Steering shaft overcenter drag torque is controlled by the steering shaft adjuster screw which determines the clearance between the rack piston and pitman shaft sector teeth.

CAUTION

The following adjustment procedures must be performed exactly as described and in the sequence outlined. Failure to do so can result in damage to the gear internal components and poor steering response. Always adjust wormshaft bearing preload first; then adjust pitman shaft overcenter drag torque last.

- (60) Seat adjuster plug assembly (5) in housing (21) using spanner wrench #J-7624. Tighten plug (21) to torque specified by table 6-2.
- (61) Place index mark on gear housing assembly (21) in line with one of the holes in adjuster plug (5).
- (62) Measure back (counterclockwise) $3/16$ to $1/4$ inch from first index mark and index mark housing (21).
- (63) Turn adjuster plug (5) counterclockwise and align adjuster plug hole with second mark made on housing (21).
- (64) Install locknut (4). Place spanner wrench or adjuster plug (5) to prevent it from turning and tighten locknut to torque specified by table 6-2 using tool #J-25194. Do not allow adjuster plug (5) to turn while tightening locknut (4).
- (65) Turn stub shaft clockwise to stop, then turn stub shaft back $1/4$ turn.
- (66) Assemble torque wrench with maximum capacity of 50 inch-pounds and 12-point deep socket and install wrench on splined end of stub shaft.
- (67) Measure amount of torque required to turn stub shaft. Take reading with beam of torque wrench at or near vertical position while turning stub shaft at an even rate.
- (68) Record reading. Torque required to turn stub shaft should be equal to that specified by table 6-2.

NOTE

If the measured torque reading is above or below the specified limits, the adjuster plug may have turned when the locknut was tightened, or the gear may be incorrectly assembled, or the wormshaft thrust bearings and races may be defective. Repair as required and remeasure preload.

- (69) Loosen self-locking nut (15). Turn machine bolt (16) counterclockwise until machine bolt (16) is fully extended, then turn machine bolt (16) back one full turn in clockwise direction.
- (70) Rotate stub shaft from stop-to-stop and count total number of turns.
- (71) Starting from either stop, turn stub shaft back $1/2$ total number of turns. This is gear center.

NOTE

When the gear is centered, the flat on the stub shaft should face upward and be parallel with the side cover (figure 5-110). In addition, the master spline on the pitman shaft should be in line with the adjuster screw (figure 5-111).

- (72) Install 50 inch-pound torque wrench and deep socket on stub shaft and place wrench in vertical position to take reading.
- (73) Rotate torque wrench 45 degrees each side of center and record highest drag torque measured on or near center.

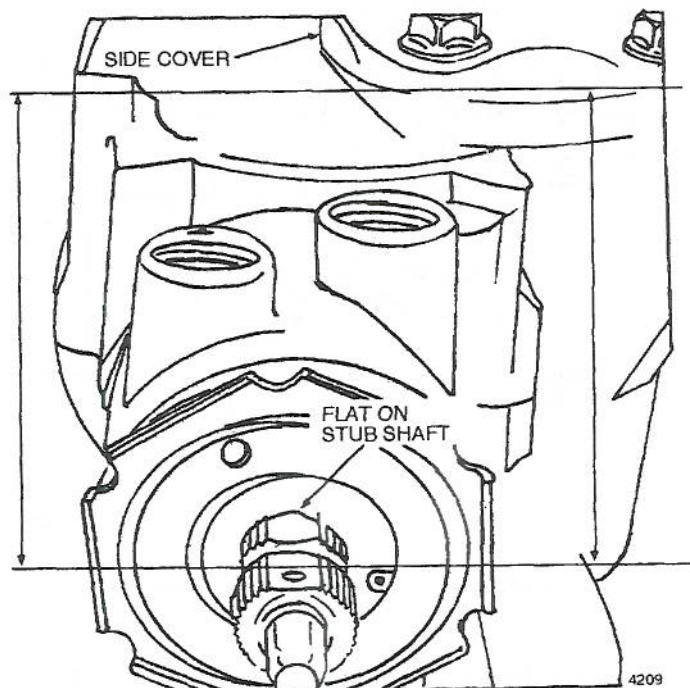
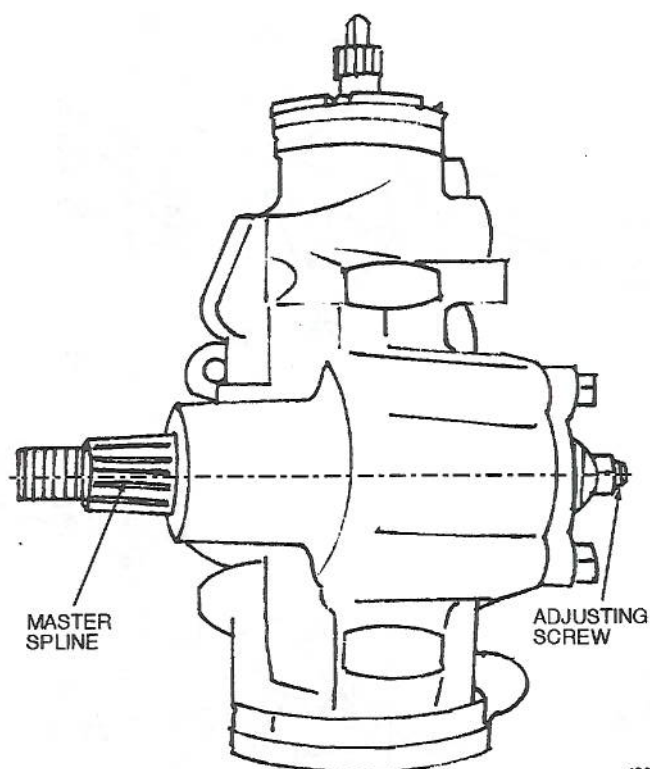


Figure 5-110. Stub Shaft Position With Gear Centered



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Figure 5-111. Pitman Shaft Master Spline Position With Gear Centered

- (74) Adjust drag torque by turning machine bolt (16, figure 5-105) clockwise until desired drag torque is obtained. Adjust drag torque to figures specified in table 6-2.
 - (75) Tighten machine bolt (16) after adjusting over-center drag torque. Tighten lash nut to torque specified by table 6-2. Use hex wrench to prevent self-locking nut (15) from turning while tightening machine bolt (16).
- f. Installation. Install steering gear components as follows:

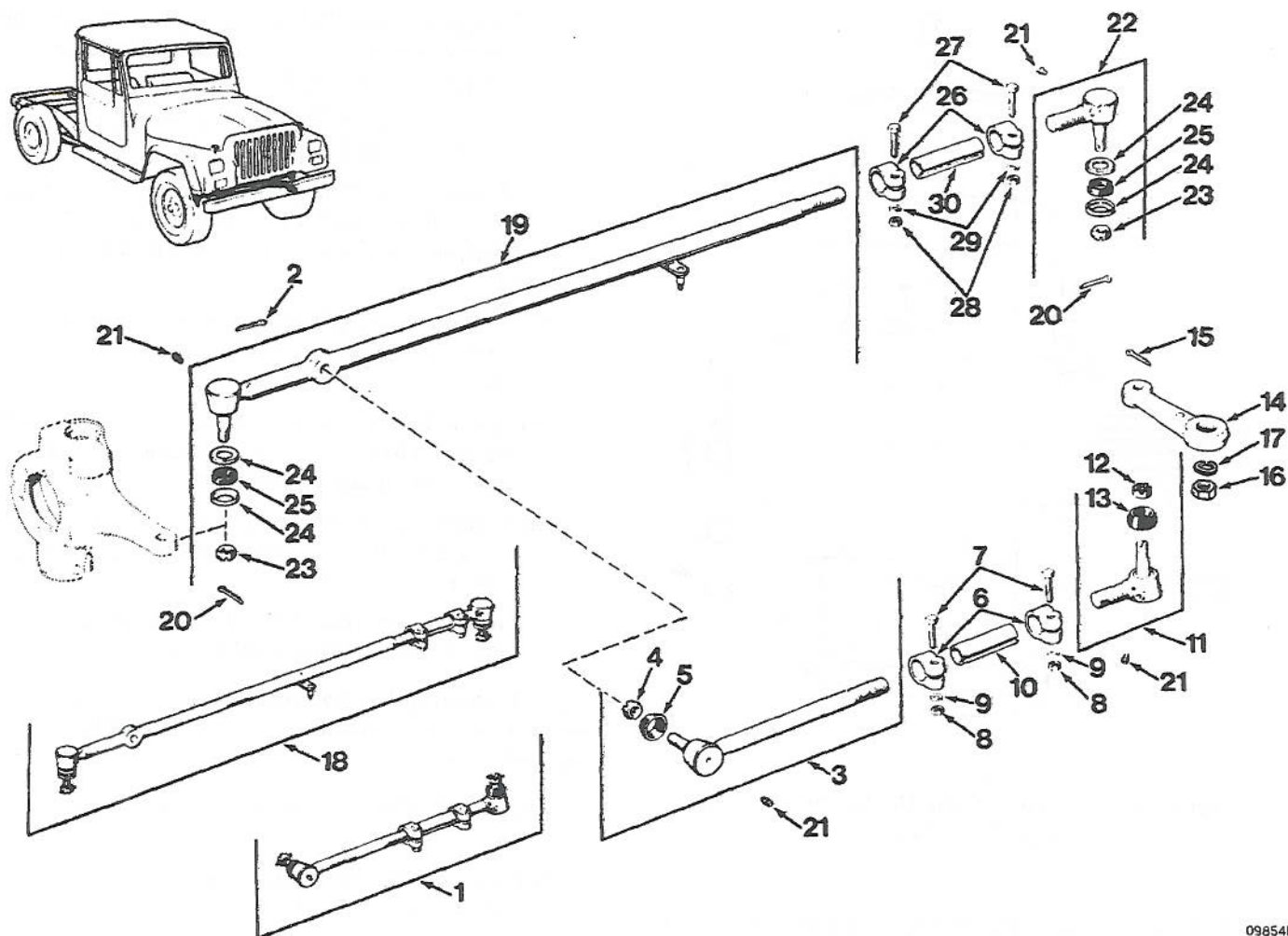
NOTE

Proper retention of the steering gear is important. Some of the following procedural steps in gear installation require the application of Loctite or equivalent material to attaching bolt threads. Wherever indicated, use Jeep Adhesive Sealant or Loctite 271 Adhesive/Sealant, or equivalent. When applying this material, clean all bolt threads thoroughly to remove dirt and grease, and apply the material liberally to the bolt threads no more than 5 minutes before installation.

- (1) Align and install flexible coupling on stub shaft and install hose clamp screw. Tighten screw to torque specified by table 6-2.
- (2) Apply Loctite (23, table 5-1) or equivalent material to special capscrews (2).
- (3) Position steering gear assembly (1) on frame and install special capscrews (2). Tighten capscrews (2) to torque specified by table 6-2.
- (4) Align and install pitman arm on steering shaft (19) using reference marks made during removal.
- (5) Install hex nut (25) and lockwasher (26). Tighten nut to torque specified by table 6-2 and stake nut in two places to retain it.
- (6) Connect pressure and return hoses to steering gear assembly. Tighten hose fittings to torque specified by table 6-2.
- (7) Refer to paragraph 5-5.4.8 and check and adjust power steering fluid level.

5-5.4.5 *Steering Linkage Group*. Refer to figure 5-112, and perform the following steps to overhaul the steering linkage group.

- a. Removal. Remove steering linkage group as follows:
 - (1) Remove hex nut (16), lockwasher (17) and power steering arm (14).
 - (2) Remove cotter pin (2), hex nut (4) and connecting rod assembly (1).
 - (3) Remove cotter pins (20), hex nuts (23) and tie rod assembly (18).
- b. Disassembly. Disassemble steering linkage group as follows:
 - (1) Remove cotter pin (15) and hex nut (12).
 - (2) Remove power steering arm (14) and dust cover (13).
 - (3) Remove nuts (8) and lockwashers (9) and capscrews (7); remove end assemblies (3) and (11).
 - (4) Remove clamps (6) from adjusting tube (10).
 - (5) Remove dust cover (5).
 - (6) Remove lubrication fittings (21).
 - (7) Remove washers (24) and dust covers (25).
 - (8) Remove hex nuts (28), lockwashers (29) and capscrews (27).
 - (9) Remove end assemblies (19) and (22).
 - (10) Remove clamps (26) from adjusting tube (30).

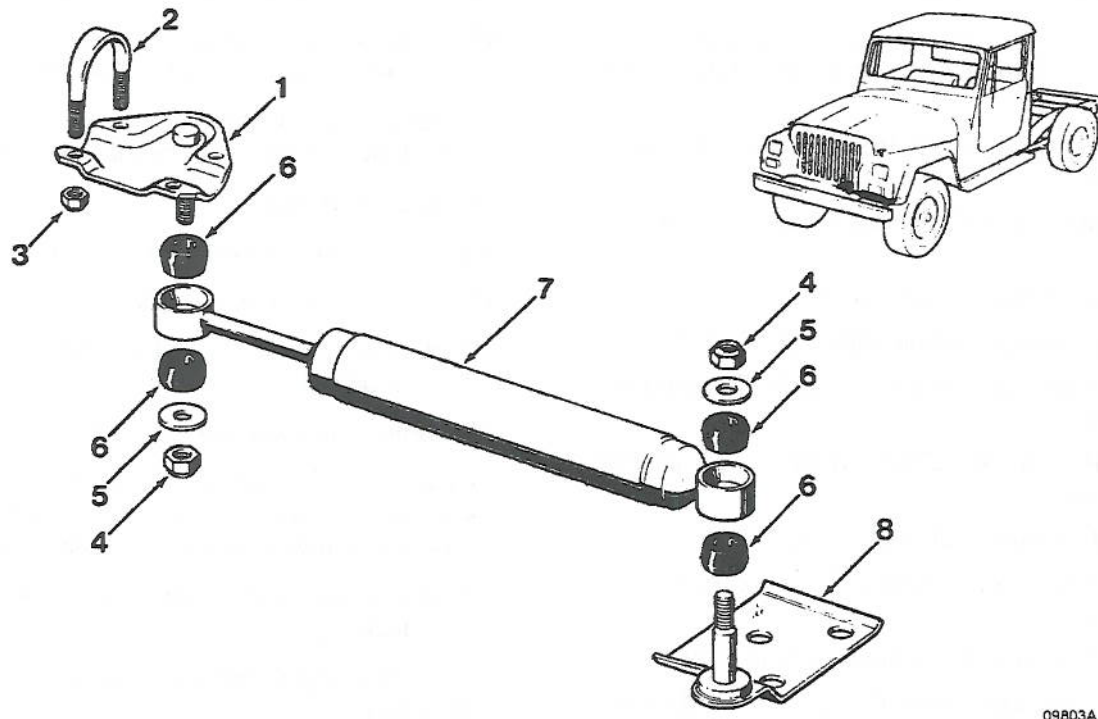


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|----------------------------|------------------------|-------------------------|
| 1. Connecting Rod Assembly | 11. End Assembly | 21. Lubrication Fitting |
| 2. Cotter Pin | 12. Slotted Hex Nut | 22. End Assembly |
| 3. End Assembly | 13. Dust Cover | 23. Plain Hex Nut |
| 4. Slotted Hex Nut | 14. Power Steering Arm | 24. Flat Washer |
| 5. Dust Cover | 15. Cotter Pin | 25. Dust Cover |
| 6. Clamp | 16. Plain Hex Nut | 26. Clamps |
| 7. Capscrew | 17. Lockwasher | 27. Capscrew |
| 8. Plain Nut | 18. Tie Rod Assembly | 28. Plain Hex Nut |
| 9. Lockwasher | 19. End Assembly | 29. Lockwasher |
| 10. Adjusting Tube | 20. Cotter Pin | 30. Adjusting Tube |

Figure 5-112. Steering Linkage Group

- (11) Remove lubrication fittings (21).
 - c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
 - d. Repair and replacement. Replace all worn or damaged parts.
 - e. Assembly. Assemble steering linkage group as follows:
 - (1) Install lubrication fittings (21).
 - (2) Install clamps (26) on adjusting tube (30).
 - (3) Install end assemblies (19) and (22) in adjusting tube (30).
 - (4) Install capscrews (27), lockwashers (29) and hex nuts (28).
 - (5) Install washers (24) and dust covers (25).
 - (6) Install lubrication fittings (21) in connecting rod assembly (1).
 - (7) Install clamps (6) on adjusting tube (10).
 - (8) Install end assemblies (3) and (11) in adjusting tube (10).
 - (9) Install capscrews (7), lockwashers (9) and nuts (8).
 - (10) Install dust covers (5) and (13).
 - (11) Install power steering arm (14) using hex nut (12) tightened to torque specified in table 6-2. Install cotter pin (15).
 - f. Installation. Install steering linkage group as follows:
 - (1) Install tie rod assembly (18) using hex nuts (23) tightened to torque specified by table 6-2 and cotter pins (20).
 - (2) Install connecting rod end assembly (3) in tie rod assembly (18) using hex nut (4) tightened to torque specified by table 6-2 and cotter pin (2).
 - (3) Install power steering arm (14) using lockwasher (17) and hex nut (16).
 - (4) Align tie rod assembly (18) and connecting rod assembly (1); tighten capscrews (27) and (7) to torques specified by table 6-2.
- 5-5.4.6 Steering Damper Group.** Refer to figure 5-113, and perform the following steps to overhaul steering damper group.
- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the steering damper group as follows:
 - (1) Place wheels in straight-ahead position.
 - (2) Remove self-locking nut (4), shock absorber (7) and washer (5) to bracket assembly (8).
 - (3) Remove self-locking nut (4) and washer (5) attaching damper (7) to bracket assembly (1).
 - (4) Remove damper.
 - (5) Remove bushings (6) from shock absorber (7).
 - (6) Remove self-locking nuts (3).
 - (7) Remove U-bolt (2) and bracket assembly (1) from tie rod.
 - (8) Remove bracket assembly (8).
 - b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following step:
 - (1) Inspect shock absorber (7) carefully for signs of leaking.
 - c. Repair and replacement. Replace all worn or damaged parts.
 - d. Assembly and installation. Assembly is accomplished during installation. Install steering rod group as follows:
 - (1) Install bracket assembly (8).
 - (2) Extend push rod of shock absorber (7) completely.
 - (3) Measure distance from cylinder of shock absorber (7) to center of push rod eyelet.
 - (4) Divide figure by two.
 - (5) Move push rod into cylinder of shock absorber (7) until center of push rod eyelet is extended to half the maximum travel of push rod.
 - (6) Scribe line on tie rod at center position between shock absorber (7) and push rod eyelet.
 - (7) Position bracket assembly (1) on tie rod with push rod stud centered over scribed line.
 - (8) Install U-bolt (2); install and tighten self-locking nuts (3) to torque prescribed by table 6-2.
 - (9) Recheck to ensure bracket assembly (1) is correct to measurement.
 - (10) Insert bushings (6) in shock absorber (7).
 - (11) Install shock absorber (7) on stud of bracket assembly (1) using self-locking nuts (4) and washers (5).



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|---------------------|---------------------|
| 1. Bracket Assembly | 5. Washer |
| 2. U-Bolt | 6. Bushing |
| 3. Self-Locking Nut | 7. Shock Absorber |
| 4. Self-Locking Nut | 8. Bracket Assembly |

Figure 5-113. Steering Damper Group

- (12) Attach shock absorber (7) to bracket assembly (8) using self-locking nut (4) and washer (5).

5-5.4.7 *Power Steering Pump Mounting Group*. Refer to figure 5-114, and perform the following steps to overhaul the power steering pump mounting group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove power steering pump mounting group as follows:



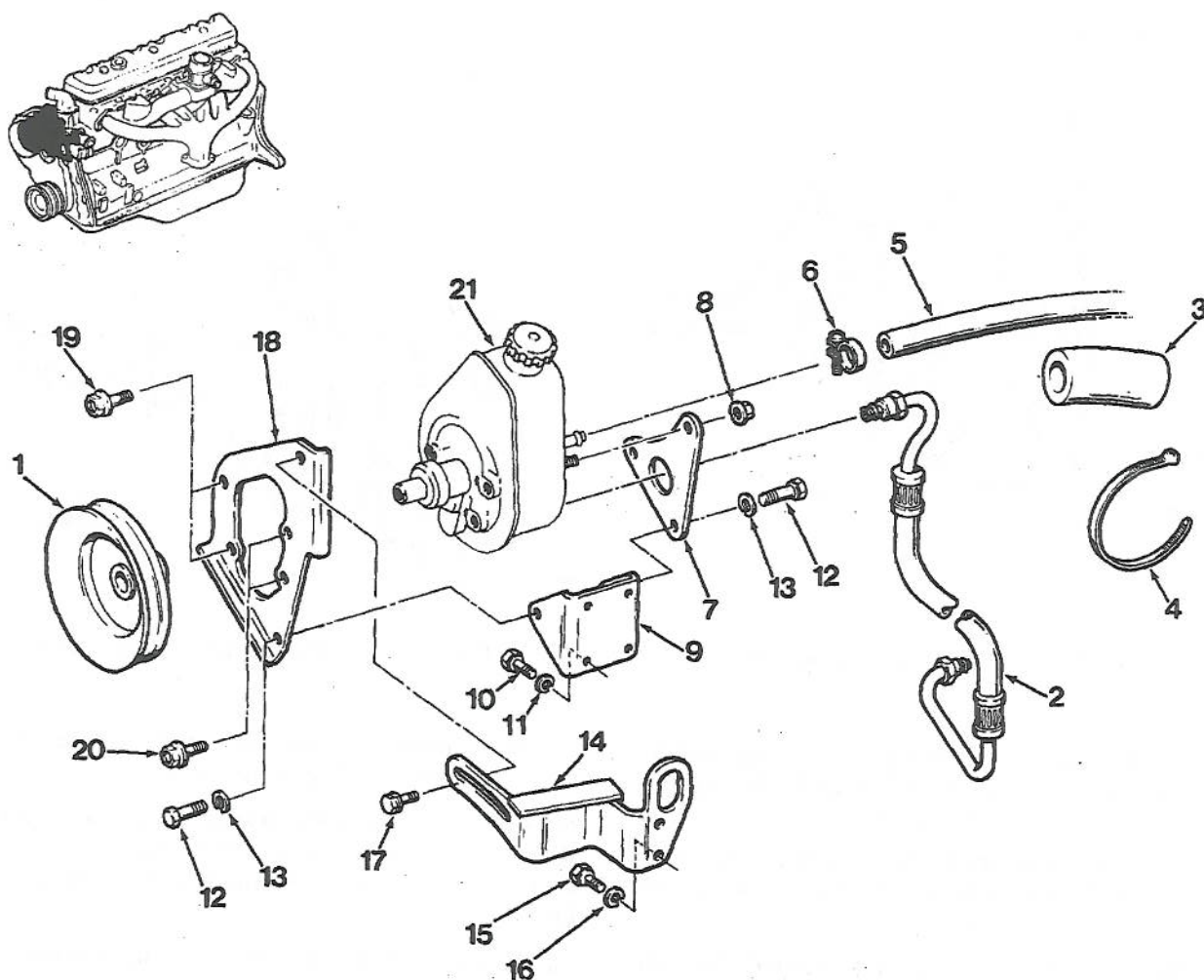
The power steering gear and pump form a closed system. Contaminants or foreign material must not be allowed to enter the system at any point. If the pump (or gear) is contaminated or damaged so as to produce debris, both the pump and gear must be disassembled, cleaned and serviced.

- (1) Loosen screw and washer (17); push pump assembly (21) toward engine and remove pump belt.
- (2) Remove pulley (1) using special tool #J-25034, as shown in figure 5-115.

NOTE

Cap hoses immediately after they are disconnected to prevent entry of dirt.

- (3) Remove hose (5, figure 5-114) by loosening clamp (6) and remove hose assembly (2).
- (4) Remove extended nuts (8), capscrews (12), lockwashers (13) and bracket (7).
- (5) Remove screw and washer (17), capscrews (12) and lockwashers (13).
- (6) Remove capscrews (19) and capscrews (20), bracket assembly (18) and power steering pump (21).

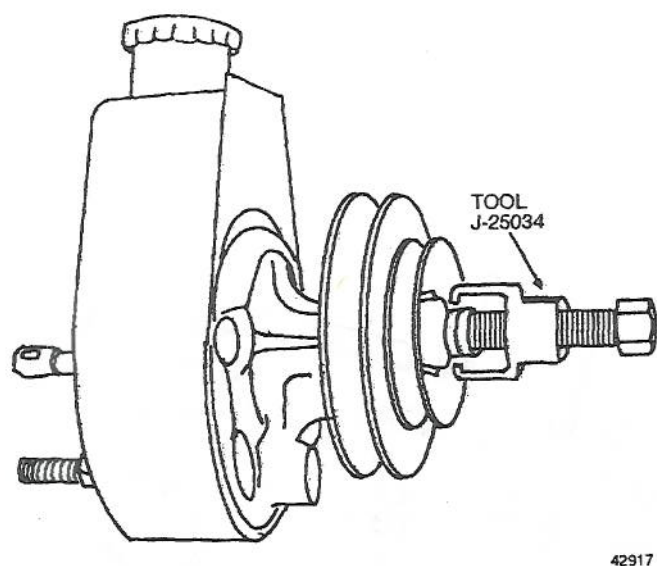


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|------------------|----------------------|-------------------------|
| 1. Pulley | 8. Extended Nut | 15. Capscrew |
| 2. Hose Assembly | 9. Bracket Assembly | 16. Lockwasher |
| 3. Hose | 10. Capscrew | 17. Screw and Washer |
| 4. Strap | 11. Lockwasher | 18. Bracket Assembly |
| 5. Hose | 12. Capscrew | 19. Capscrew |
| 6. Clamp | 13. Lockwasher | 20. Lockwasher |
| 7. Bracket | 14. Bracket Assembly | 21. Power Steering Pump |

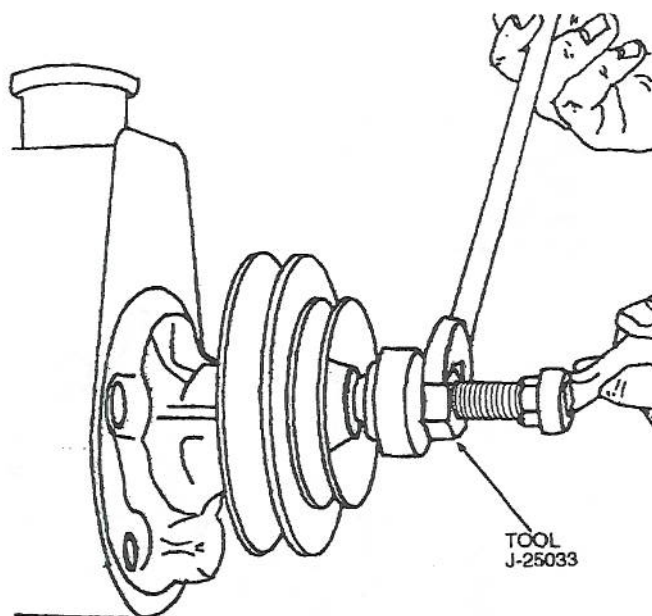
Figure 5-114. Power Steering Pump Mounting Group

- (7) Remove capscrews (10), lockwashers (11) and bracket assembly (9).
- (8) Remove capscrews (15), lockwashers (16) and bracket assembly (14).
- (9) Remove strap (4) and sleeve (3).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install the power steering pump mounting group as follows:
 - (1) Install bracket assembly (14) using capscrews (15) and lockwashers (16). Tighten to torque specified in table 6-2.



42917

Figure 5-115. Pump Pulley Removal



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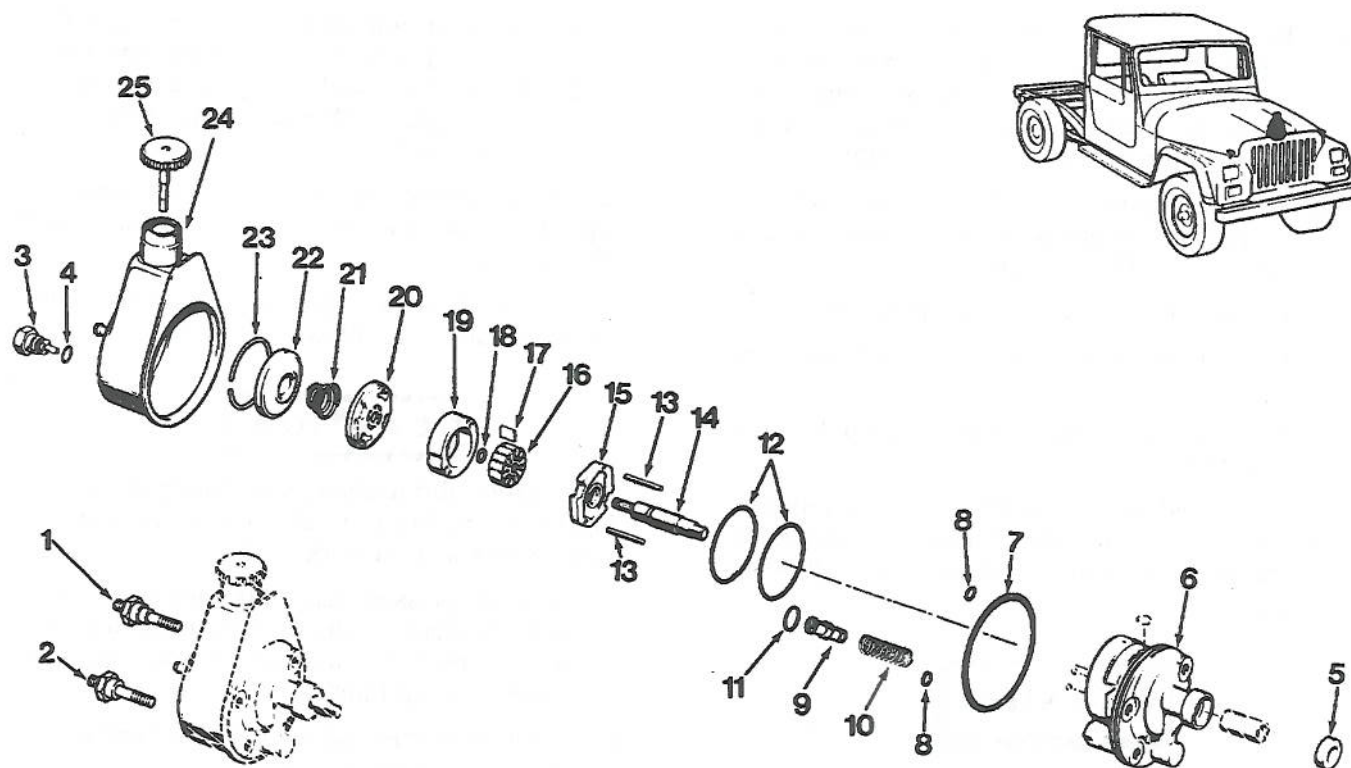
Figure 5-116. Pump Pulley Installation

- (2) Install bracket assembly (18) on pump assembly (21) using capscrews (19) and (20). Tighten to torque specified in table 6-2.
- (3) Install bracket assembly (9) using capscrews (10) and lockwashers (11). Tighten to torque specified in table 6-2.
- (4) Install bracket (7) on pump assembly (21) with extended nuts (8).
- (5) Install power steering pump (21) in bracket assembly (9) with capscrews (12) and lockwashers (13). Tighten to torque specified in table 6-2.
- (6) Install hose assembly (2) and tighten hose fittings to torque specified in table 6-2.
- (7) Install hose assembly (5) with clamp (6) and tighten clamp (6) to torque specified in table 6-2.
- (8) Install sleeve (3) and strap (4).
- (9) Install screw and washer (17) finger tight.
- (10) Install pulley (1) using tool #J-25033, as shown in figure 5-116.
- (11) Install pump belt and adjust belt tension according to procedures in paragraph 5-5.1.10.

- (12) Tighten screw and washer (17, figure 5-114) to torque specified in table 6-2.

5-5.4.8 *Power Steering Hydraulic Pump Assembly.* Refer to figure 5-117, and perform the following steps to overhaul the power steering hydraulic pump assembly.

- a. Removal. Remove power steering hydraulic pump assembly as follows:
 - (1) Loosen pump adjusting bracket bolts and nuts and remove pump belt. Also remove air pump belt, if present.
 - (2) Disconnect pressure and return hoses at pump. Cap hoses to prevent dirt entry.
 - (3) Remove nuts from mounting studs (1) and (2) and remove pump assembly.
- b. Disassembly. Disassemble steering hydraulic pump assembly as follows:
 - (1) Remove cap (25) and drain fluid from pump.
 - (2) Reinstall cap (25) and clean pump with solvent to remove exterior dirt.
 - (3) Remove pump pulley using tool #J-25034.



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|----------------------|---------------------------|------------------------|
| 1. Stud | 9. Control Valve Assembly | 17. Pump Vane |
| 2. Stud | 10. Valve Spring | 18. Retaining Ring |
| 3. Assembly Fitting | 11. Preformed Packing | 19. Pump Ring |
| 4. Preformed Packing | 12. Preformed Packing | 20. Pressure Plate |
| 5. Seal | 13. Pin | 21. Spring |
| 6. Pump Housing | 14. Drive Shaft | 22. End Plate |
| 7. Preformed Packing | 15. Thrust Plate | 23. Retaining Ring |
| 8. Preformed Packing | 16. Pump Rotor | 24. Reservoir Assembly |
| | | 25. Cap |

Figure 5-117. Power Steering Hydraulic Pump Assembly

CAUTION

Inspect the exposed surface of the pump shaft. Remove all traces of corrosion or nicks and scratches before disassembling the pump. This will prevent damage to the pump occurring during disassembly which might necessitate replacement of the entire pump body. Do not overtighten vise as pump body could be distorted.

(4) Mount pump in vise with shaft facing downward.

- (5) Remove assembly fitting (3) and preformed packing (4).
- (6) Remove studs (1) and (2).
- (7) Remove pump reservoir (24) and preformed packing (7) from pump housing (6).
- (8) Remove preformed packings (8).
- (9) Remove retaining ring (23), end plate (22) and spring (21).
- (10) Remove preformed packing (11), control valve assembly (9) and valve spring (10).

- (11) Remove drive shaft (14), thrust plate (15), pump rotor (16), vanes (17), pump ring (19) and pressure plate (20) as an assembly. Remount pump in vise so shaft bore faces downward and tap end of pump shaft to remove assembly.
 - (12) Remove retaining ring (18), pressure plate (20), pump ring (19), pump rotor (16), vanes (17) and thrust plate (15) from shaft.
 - (13) Remove pins (13) from thrust plate (15).
 - (14) Remove preformed packings (12) from pump body bore.
 - (15) Remove seal (5) from housing assembly using tool #J-8842.
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure may not exceed 30 psi and wearing of goggles is required.

- (1) Discard all preformed packings and seals, clean remaining parts in solvent (7, table 5-1) and dry with filtered compressed air.
- (2) Inspect control valve assembly (9) and valve bore for pitting, scoring or wear and inspect valve spring for distortion or loss of tension.
- (3) Insert valve (9) in valve bore and check for free movement.
- (4) If either valve (9) or spring (10) fails to operate correctly, they must be replaced as an assembly. If valve bore is damaged, pump body must be replaced.
- (5) Check capscrew located in end of control valve assembly (9). Tighten capscrew if loose.
- (6) Inspect pressure plate (20), pump ring (19) and thrust plate (15) for wear, cracks, pitting, etc. Also, check surfaces for flatness.
- (7) Inspect rotor (16) surfaces for pitting, wear, cracks or scoring. Check all vanes (17) for free movement in rotor slots. If rotor (16) or vanes (17) are damaged, they must be replaced.
- (8) Inspect pump shaft (14) for nicks, scoring, wear, cracks or worn splines. If pump shaft (14) exhibits any of these conditions, it must be replaced.

- (9) Inspect pump body and reservoir assembly (29) for cracks, porosity or distortion and check pump body bores and O-ring counter bores for damage. Replace either part if any of these conditions is noted.

- d. Repair and replacement. Replace all worn or damaged parts. All seals and preformed packings must be replaced.
- e. Assembly. Assemble power steering hydraulic pump assembly as follows:

CAUTION

Do not allow dirt to enter pump during assembly. Clean and lubricate all parts and perform assembly on a clean work surface.

- (1) Lubricate pressure plate (20), end plate (22) and all replacement O-ring seals with petroleum jelly (21, table 5-1). Lubricate all other parts with power steering fluid.
- (2) Install preformed packing (12) in third groove of pump housing (6) bore.
- (3) Install pins (13) in thrust plate (15).
- (4) Position pump rotor (17) on thrust plate (15) and align shaft bores in rotor (17) and thrust plate (15).

CAUTION

Do not overspread retaining ring. Open it only enough to install it.

- (5) Assemble drive shaft (14), thrust plate (15) and pump rotor (17) and install retaining ring (18).
- (6) Install assembled thrust plate (15), pump rotor (17) and drive shaft (14) in pump housing (6) bore.
- (7) Align pins (13) with dowel holes in pump ring (19).
- (8) Install pump ring (19) on pins (13) and over pump rotor (16) and thrust plate (15). Pump rotation arrow must face upward when pump ring (19) is installed. Do not displace preformed packing (12) during installation of pump ring (19).
- (9) Install rotor vanes (17) in pump rotor (16) slots. Rounded edges of vanes must face outward.
- (10) Lubricate outside diameter and chambered surface of pressure plate (20) with petroleum jelly (21, table 5-1).

- (11) Install pressure plate (20) on pins (13). Spring groove in pressure plate (20) must face upward when installed.
- (12) Seat pressure plate (20).
- (13) Lubricate remaining preformed packing (12) in second groove of pump housing (6) bore.
- (14) Install spring (21) on pressure plate (20). Be sure spring is rested in spring groove.
- (15) Lubricate outside diameter of end plate (22) with petroleum jelly (21, table 5-1) and install end plate (22) in housing assembly (6) bore.
- (16) Press end plate downward and install retaining ring (23).
- (17) Install preformed packing (11) on control valve assembly (9) and insert hex end of control valve assembly (9) in valve spring (10). Install assembled valve (9) and spring (10) in housing assembly (6) valve bore and install assembly in bore, spring end first.
- (18) Lubricate and install preformed packings (8) in housing assembly (6) counter bores.
- (19) Lubricate preformed packing (7) with petroleum jelly (21, table 5-1) and install preformed packing (7) in housing assembly seal groove.
- (20) Lubricate preformed packing (7) surface with petroleum jelly (21, table 5-1) and install reservoir assembly (24) on housing assembly. Be sure reservoir is aligned with stud bores and seals. Install seal (5).

CAUTION

Be careful to avoid displacing or damaging any of the seals during assembly. Use a wood or plastic tool to keep the preformed packing in its groove when installing the reservoir.

- (21) Install studs. Tighten to torque specified by table 6-2.
- (22) Lubricate preformed packing (4) with petroleum jelly (21, table 5-1) and install preformed packing (4) an assembly fitting (3).
- (23) Install assembly fitting (3) in control valve assembly (9) bore and tighten to torque specified by table 6-2.

CAUTION

Some pump units have metric threaded assembly fittings which are designed for use with

metric hose fittings that use an O-ring seal. If the fitting is to be replaced, be sure to install the correct thread-type fitting.

- (24) Install pump pulley using tool #J-25033.
- f. Installation. Install power steering hydraulic pump assembly as follows:
 - (1) Install pump assembly, tightening nuts on studs (1) and (2) to torque specified by table 6-2.
 - (2) Connect pressure and return hoses at pump.
 - (3) Install pump belt and tighten adjusting bracket nuts and bolts to torque specified by table 6-2.
 - (4) Add fluid and cap (25).

5-5.5 Front Axle and Suspension.

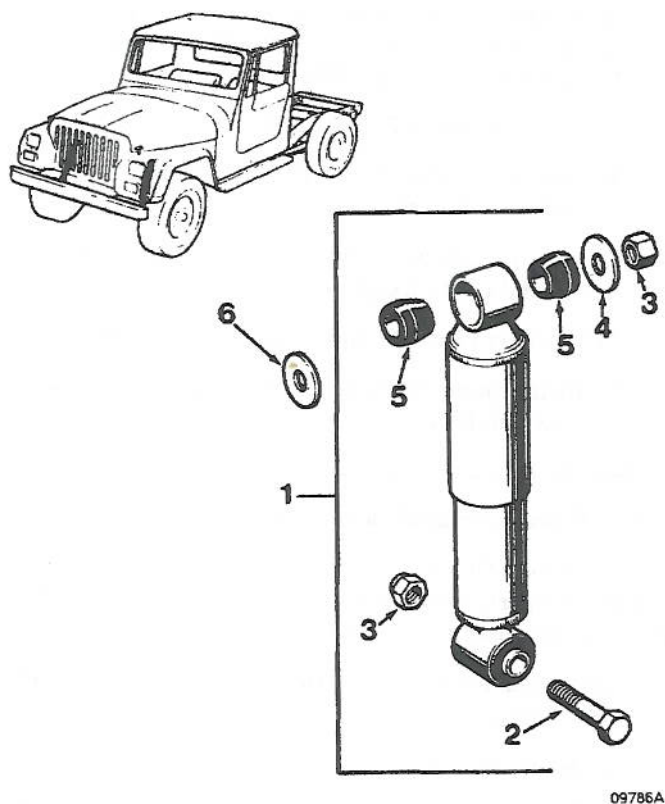
5-5.5.1 *Front Shock Absorber Group.* Refer to figure 5-118, and perform the following steps to overhaul the front shock absorber group.

- a. Removal. Remove the front shock absorber group as follows:
 - (1) Raise vehicle.
 - (2) Position hydraulic jack under axle and raise axle to relieve springs of axle weight.
 - (3) Remove self-locking nuts (3) and flat washers (4) from top mounting pins.
 - (4) Remove self-locking nuts (3) from capscrews (2) and remove capscrews (2).
 - (5) Remove shock absorber assemblies (1) and flat washers (6); remove bushings (5) from shock absorber mounting eyes.
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace worn shock absorbers and any worn or damaged attaching parts.
- d. Installation. Install shock absorber assembly as follows:
 - (1) Install bushings (5) in shock absorber mounting eyes.

NOTE

Do not lubricate bushings before installing them in shock absorber mounting eyes.

- (2) Install flat washers (6) and position shock absorbers on top mounting pins.
- (3) Install capscrews (2).



- | | |
|----------------------------------|----------------|
| 1. Front Shock Absorber Assembly | 4. Flat Washer |
| 2. Capscrew | 5. Bushing |
| 3. Self-Locking Nut | 6. Washer |

Figure 5-118. Front Shock Absorber Group

- (4) Install self locking nuts (3) on cap screws (2) and tighten to torque prescribed by table 6-2.
- (5) Install flat washers (4) and self-locking nuts (3) on top mounting pins and tighten to torque prescribed by table 6-2.
- (6) Lower axle, remove hydraulic jack and lower vehicle.

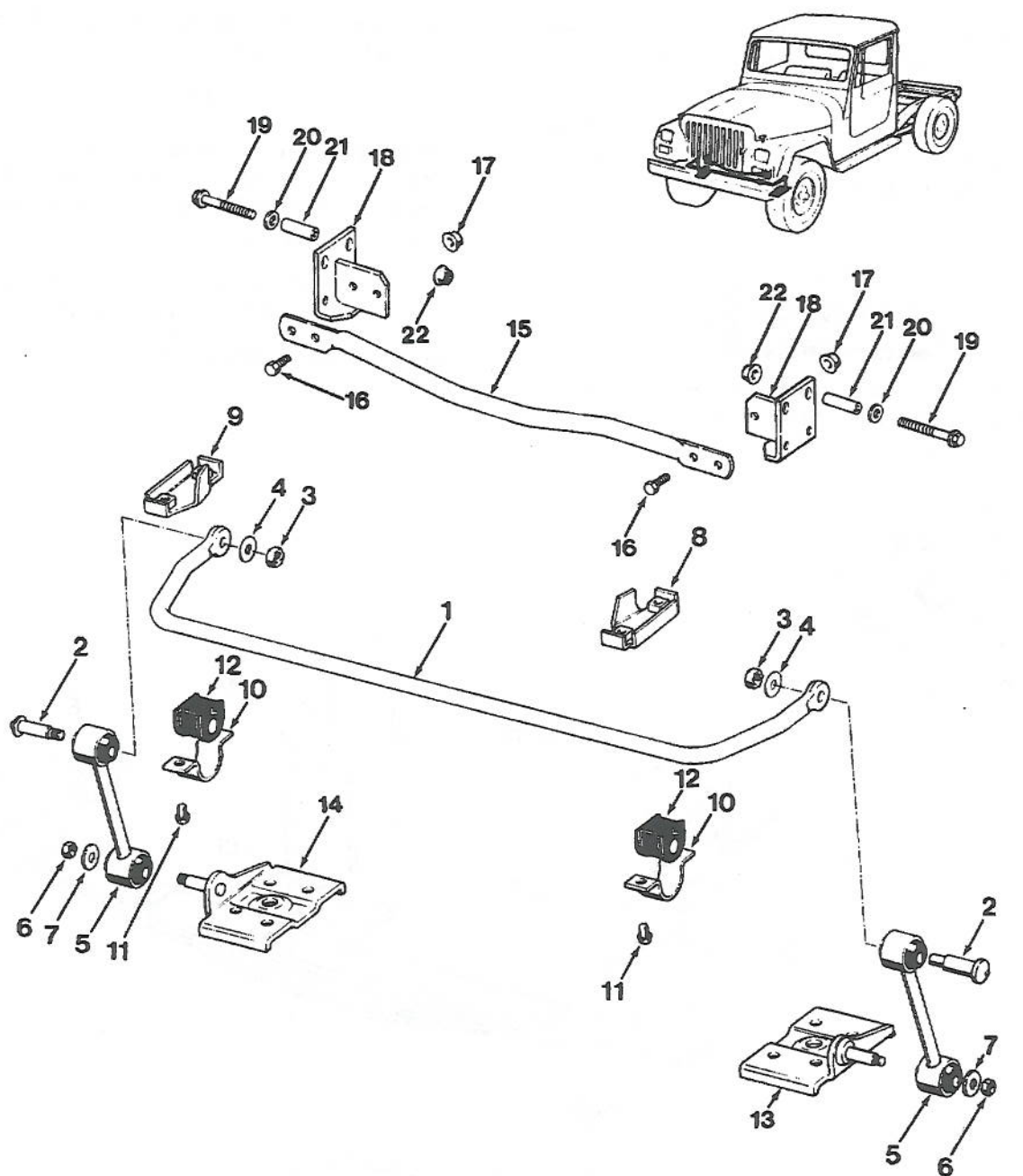
5-5.5.2 *Front Stabilizer Bar Group.* Refer to figure 5-119, and perform the following steps to overhaul the stabilizer bar group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove front stabilizer bar group as follows:

- (1) Remove self-locking nuts (6) and washers (7).
- (2) Remove hex nuts (3) and washers (4).

- (3) Remove pins (2) and connecting link assemblies (5).
- (4) Remove shaft and spring bracket assemblies (13) and (14).
- (5) Remove machine screws (11), stabilizer bracket assemblies (10) and bushings (12).
- (6) Remove front stabilizer bar (1).
- (7) Remove right and left stabilizer bracket assemblies (8) and (9).
- (8) Remove hex nuts (17) and cap screws (16) and remove tie bar (15).
- (9) Remove hex nuts (22), machine screws (19), spacer tubes (21) and washers (20) and remove tie bar brackets (18).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install front stabilizer bar group as follows:

- (1) Install tie bar brackets (18) using machine screws (19) washers (20), spacer tubes (21) and hex nuts (22).
- (2) Install tie bar (15) on tie bar brackets (18) using cap screws (16) and hex nuts (17).
- (3) Install right and left stabilizer bracket assemblies (8) and (9).
- (4) Position front stabilizer bars (1) and install bushings (12) and stabilizer bracket assemblies (10) using machine screws (11). Tighten machine screws to torque specified by table 6-2.
- (5) Install connecting link assemblies (5) on stabilizer bars (1) using pins (2), lockwashers (4) and self-locking nuts (3). Tighten self-locking nuts to torque prescribed by table 6-2.
- (6) Install right and left shaft and spring bracket assemblies (13) and (14).
- (7) Secure connecting link assemblies (5) to right and left stabilizer bracket assemblies (13) and (14).



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|-------------------------------|---|---------------------|
| 1. Front Stabilizer Bar | 8. Left Stabilizer Bracket Assembly | 15. Tie Bar |
| 2. Pin | 9. Right Stabilizer Bracket Assembly | 16. Capscrew |
| 3. Hex Nut | 10. Stabilizer Bar Mounting Bracket | 17. Hex Nut |
| 4. Lockwasher | 11. Machine Screw | 18. Tie Bar Bracket |
| 5. Connecting Link Assemblies | 12. Bushing | 19. Machine Screw |
| 6. Self-Locking Nut | 13. Shaft and Spring Bracket Assemblies | 20. Washer |
| 7. Washer | 14. Shaft and Spring Bracket Assemblies | 21. Spacer Tube |
| | | 22. Hex Nut |

Figure 5-119. Front Stabilizer Bar Group

5-5.5.3 *Front Spring Group*. Refer to figure 5-120, and perform the following steps to overhaul the front spring group.

- a. Removal and disassembly. Disassembly of the front springs is accomplished during removal. Remove the front springs as follows:

- (1) Raise vehicle.

WARNING

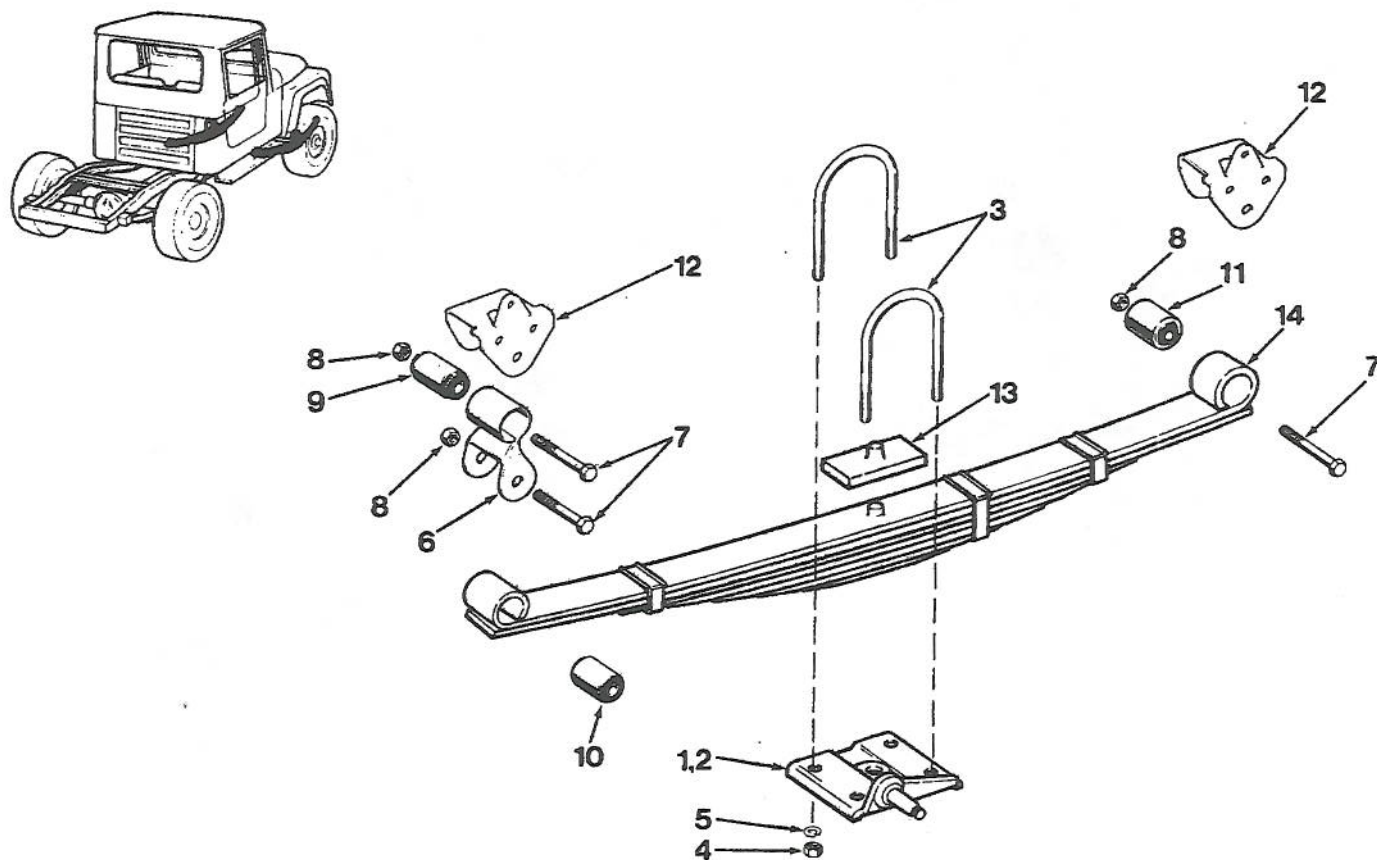
When working under chassis, raise suspension and install safety jack stands or injury to personnel may occur.

- (2) Support vehicle using safety jack stands placed under frame rails.

NOTE

There are two front spring assemblies. Use the following procedures to remove one of the assemblies. Repeat for the remaining assembly (steps 3 through 12).

- (3) Position hydraulic jack under axle and raise axle to relieve springs of axle weight.
(4) Disconnect stabilizer bar.



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|----------------------------------|---------------------------|
| 1. Bracket Assembly | 8. Self-Locking Nut |
| 2. Bracket Assembly | 9. Bushing |
| 3. Spring Clip Belt | 10. Bushing |
| 4. Hex Plain Bolt | 11. Bushing |
| 5. Lockwasher | 12. Spring Pivot Bracket |
| 6. Front Spring Shackle Assembly | 13. Front Spring Spacer |
| 7. Capscrew | 14. Front Spring Assembly |

Figure 5-120. Front Spring Group

- (5) Remove hex nuts (4), lockwashers (5), spring clip bolts (3) and one of the bracket assemblies (1) left, (2) right.
- (6) Remove front spring spacer (13).
- (7) Remove self-locking nut (8) and hex head cap-screw (7) from rear spring pivot bracket (12).
- (8) Remove lower self-locking nut (8), capscrow (7) and front spring shackle assembly (6) from front spring assembly (14).
- (9) Remove front spring assembly (14).
- (10) Refer to figure 5-121 to remove small bushing from right front spring shackle assembly (6, figure 5-120) as follows in steps (11) through (19).
- (11) Insert 3/8 inch by 8 inch length of threaded rod through bushing. Center bushing on rod.

CAUTION

When removing bushing, press only on metal outer sleeve or damage to bushing may result.

- (12) Place socket of diameter large enough to bear against metal outer sleeve of bushing, but small enough to pass through the front spring (14) eye, on one end of the threaded rod with open end of socket toward bushing. Socket will serve as bushing driver.

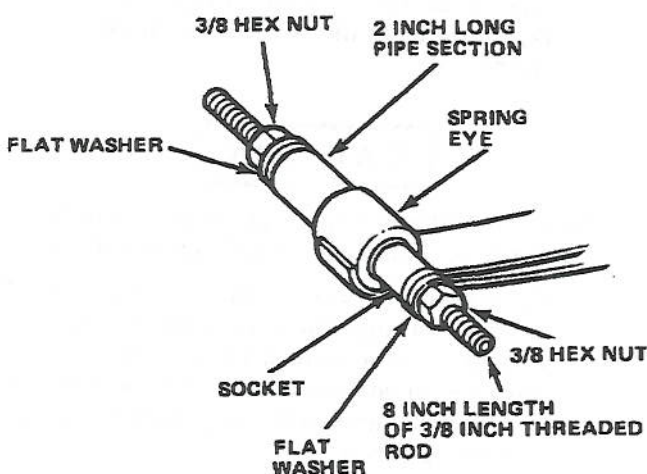


Figure 5-121. Bushing Replacement Tools - Small Bushing

- (13) Install one flat washer and one hex nut on rod behind the socket.
- (14) Install 2 inch length of pipe with diameter large enough to accommodate bushing, but small enough to seat firmly against front spring assembly (14) eye, on opposite end of threaded rod. Pipe will serve as bushing receiver.
- (15) Install one flat washer and one hex nut on rod to hold pipe section in place. Flat washer must be of large enough diameter to support and maintain alignment of pipe section.
- (16) Tighten both hex nuts, finger tight.
- (17) Align socket with bushing and align bushing with front spring (14) eye. The pipe section must butt against the front spring (14) eye surface so bushing can pass through it. Socket will act as a press ram and press the bushing out of spring (12) eye and into the pipe.
- (18) Tighten nut at socket end of rod until bushing is pressed out of spring eye into pipe.
- (19) Remove bushing tools and bushing.
- (20) Refer to figure 5-122 to remove large bushing from right front spring shackle assembly as follows in steps (21) through (29).
- (21) Insert 1/2 inch by 11 inch length of threaded rod through bushing. Center bushing on rod.

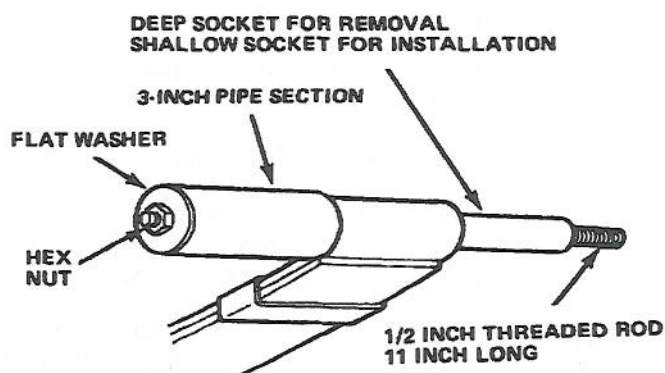


Figure 5-122. Bushing Replacement Tools - Large Bushing

CAUTION

When removing bushing, press only on metal outer sleeve or damage to bushing may result.

- (22) Place deep socket of diameter large enough to bear against metal outer sleeve of bushing, but small enough to pass through front spring (14, figure 5-120) eye, on one end of threaded rod with open end of socket toward bushing. Socket will serve as bushing driver.
 - (23) Install one flat washer and one hex nut on rod behind socket.
 - (24) Install a 3 inch length of pipe with diameter large enough to accommodate bushing, but small enough to seat firmly against the spring (12) eye, on opposite end of threaded rod. Pipe will serve as bushing receiver.
 - (25) Install flat washer and hex nut on rod to hold pipe section in place. Flat washer must be of large enough diameter to support and maintain alignment of pipe section.
 - (26) Tighten both nuts finger tight.
 - (27) Align socket with bushing and align bushing with front spring (14) eye. Pipe section must butt against front spring (14) eye surface so bushing can pass through it. Socket will act as a press ram and press the bushing out of the front spring (14) eye and into the pipe.
 - (28) Tighten nut at socket and press bushing out of front spring (14) eye.
 - (29) Remove bushing tools and bushing.
 - (30) Refer to figure 5-120 and remove self-locking nut (8), capscrow (7), front spring shackle assembly (6) and two spring pivot brackets (12).
 - (31) Use method described in steps (11) through (19) to remove small bushing (9) from left front spring shackle assembly (6).
 - (32) Use method described in steps (21) through (29) to remove large bushing (11) from left front spring shackle assembly (6).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures. In addition, check for the following:
- (1) Inspect bushings (9), (10) and (11) for looseness in front spring (14) eye.

- (2) Inspect bushings (9), (10) and (11) for alignment. They should be centered in front spring (14) eye.

- (3) Inspect bushings (9), (10) and (11) for deterioration of bushing rubber.

- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. There are two front springs assemblies. Perform steps (1) through (8) to install one of the assemblies, then repeat to install the remaining assembly. Assembly of front springs is accomplished during installation. Install the front springs as follows:

WARNING

When working under chassis, raise suspension and install safety jack stands or injury to personnel may occur.

NOTE

Vehicle should be in raised position. Refer to paragraph 5-5.5.3a, Removal and disassembly, steps (1) through (3).

- (1) Refer to figure 5-122 and install large bushing (11, figure 5-120) in right front spring shackle assembly (6) as follows in steps (2) through (10).
- (2) Center bushing on 1/2 inch by 11 inch length of pipe. Slide 3 inch length of pipe over bushing. Pipe must be of diameter to seat firmly against spring eye.

CAUTION

When installing bushings, press only on metal outer sleeve or damage to bushing may result.

- (3) Place shallow socket of diameter small enough to pass through the pipe section, but large enough to bear against metal outer sleeve of bushing, on one end of threaded rod with open end of socket toward bushing. Socket will serve as bushing driver.
- (4) Install flat washer and hex nut on rod behind socket.
- (5) Insert rod through front spring (14) eye. Seat pipe section firmly against front spring (14) eye.
- (6) Install flat washer and hex nut on end of rod against front spring (14) eye. Diameter of flat washer must exceed diameter of spring eye.

- (7) Align socket with bushing and align bushing with front spring (14) eye. The pipe section must butt against the spring eye surface so bushing can pass through it. Socket will act as a press ram and press the bushing out of the pipe into the front spring (14) eye.
- (8) Tighten nut at socket and press bushing into spring eye.
- (9) Loosen tools and check bushing position. Bushing must be centered in front spring (14) eye. Ends of bushing must be flush with or slightly inset from ends of front spring (14) eye.
- (10) If bushing is not centered, tighten tools and correct bushing position. If it is centered, remove tools.
- (11) Refer to figure 5-121 and install small bushing in right front spring shackle assembly (6, figure 5-120) as follows in steps (12) through (20).
- (12) Center bushing on 3/8 inch by 8 inch length of threaded rod. Slide 2 inch length of pipe over bushing. Pipe must be of diameter to seat firmly against front spring (14) eye.



When installing bushing, press only on metal outer sleeve or damage to bushing may result.

- (13) Place socket of diameter small enough to pass through pipe, but large enough to bear against metal outer sleeve of bushing, on one end of threaded rod with open end of socket toward bushing. Socket will serve as bushing driver.
- (14) Install flat washer and hex nut on rod behind socket.
- (15) Insert rod through front spring (14) eye. Seat pipe section firmly against spring (12) eye.
- (16) Install one flat washer and one hex nut on end of rod against front spring (14) eye. Diameter of flat washer must exceed diameter of front spring (14) eye.
- (17) Align socket with bushing and align bushing with front spring (14) eye. The pipe section must butt against the spring eye surface so bushing can pass through it. Socket will act as a press ram and press the bushing out of the pipe into front spring (14) eye.
- (18) Tighten nut at socket and press bushing into spring eye.
- (19) Loosen tools and check bushing position. Bushing must be centered in front spring (14) eye. Ends of bushing must be flush with, or slightly inset from, ends of front spring (14) eye.
- (20) If bushing is not centered, tighten tools and correct bushing position. If it is centered, remove tools.
- (21) Use method described in steps (1) through (10) to install small bushing (9) in left front spring shackle assembly (6).
- (22) Use method described in steps (12) through (20) to install large bushing (11) in left front spring shackle assembly (6).
- (23) Refer to figure 5-120 and install spring pivot brackets (12).
- (24) Install shackle assembly (13) on spring pivot bracket (12) with self-locking nut (8) and capscrew (7).
- (25) Position front spring assembly (14) rear eye in shackle (6) and loosely install self-locking nut (8) and capscrew (7). Do not tighten.
- (26) Position axle on front spring (14) and install spring bracket assembly (1) left, (2) right; front spring spacer (13); spring clip bolts (3); lockwashers (5) and hex plain nuts (4).
- (27) Connect stabilizer bar.
- (28) Remove hydraulic jack and safety stands.
- (29) Lower vehicle.

5-5.5.4 Front Axle Housing Group. Refer to figure 5-123, and perform the following steps to overhaul the front axle housing group.

- a. Removal. Remove front axle housing group as follows:
 - (1) Refer to paragraph 5-5.7.2 and remove front wheels.
 - (2) Refer to paragraph 5-5.4.5 and remove tie rod.
 - (3) Refer to paragraph 5-5.5.1 and remove front shock absorbers.
 - (4) Refer to paragraph 5-5.5.2 and remove stabilizer bar.
 - (5) Refer to paragraphs 5-5.7.6 and 5-5.7.7; remove front brake caliper and front brake disc.

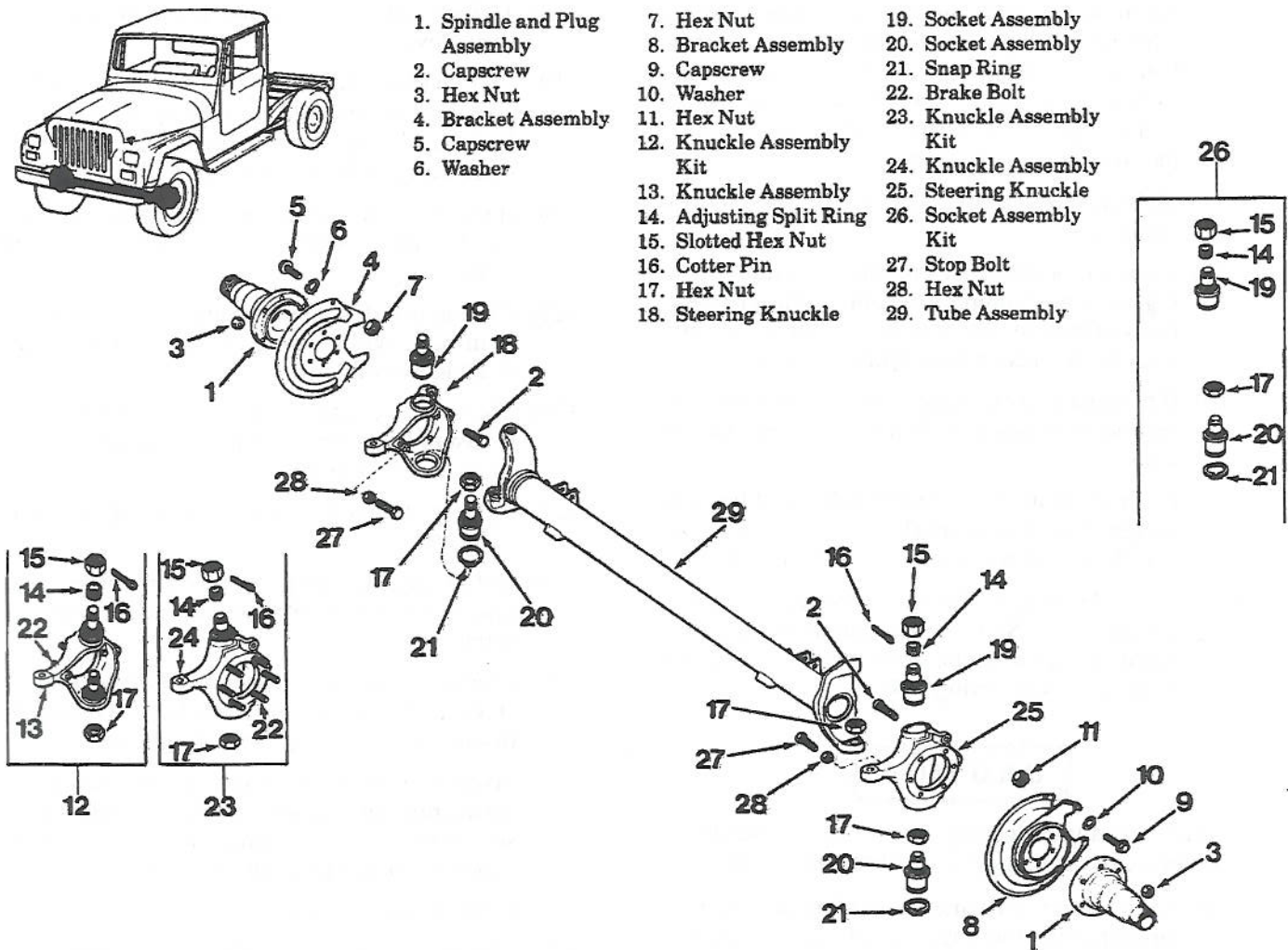


Figure 5-123. Front Axle Housing Group

- (6) Refer to paragraph 5-5.4.5 and remove U-bolts and tie plates.
- (7) Support axle housing assembly on hydraulic jack and raise jack slightly to relieve spring tension.
- (8) Refer to paragraph 5-5.5.3 and remove front springs.
- (9) Remove hydraulic jack and axle housing assembly from under vehicle.

- b. Disassembly. Disassemble rear axle housing group as follows:

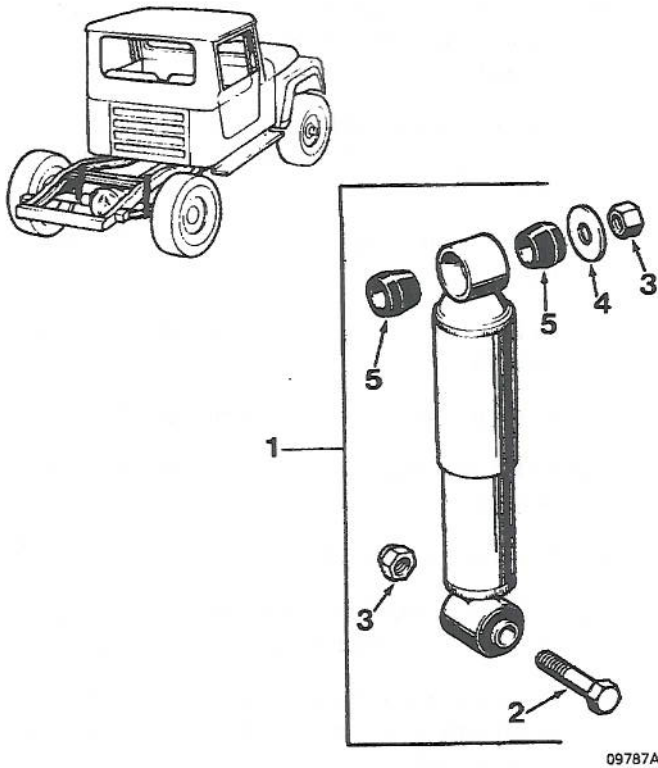
- (1) Remove knuckle assembly kit (12) and (23) and disassemble cotter pins (16), slotted hex nuts (15) and adjusting split rings (14) from steering knuckles (18) and (25).
- (2) Remove socket assembly kit (26) and disassemble snap rings (21), socket assemblies (20) and hex nuts (17) from knuckle assemblies (13) and (24).

- (3) Remove steering knuckles (18) and (25) from tube assembly (29) and remove socket assemblies (19).
- (4) Remove capscrews (2) and hex nuts (3) and remove bracket assemblies (4) and (8) and spindle and plug assemblies (1).
- (5) Remove brake bolts (22).
- (6) Remove stop bolts (27) and hex nuts (28).
- (7) Remove capscrews (5) and (9), washers (6) and (10) and hex nuts (7) and (11).
- c. Cleaning and inspection. Refer to paragraph 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- d. Repair and replacement. Replace all worn or damaged parts.
- e. Assembly. Assemble front axle housing group as follows:
 - (1) Install capscrews (5) and (9), washers (6) and (10) and hex nuts (5) and (11).
 - (2) Install stop bolts (27) and hex screws (28).
 - (3) Install brake bolts (22).
 - (4) Install bracket assemblies (4) and (8); install spindle and plug assemblies on steering knuckles (18) and (25) using capscrews (2) and hex nuts (3).
 - (5) Install socket assemblies (19) on steering knuckles (18) and (25) and install steering knuckles (18) and (25) on tube assembly (29).
 - (6) From socket assembly kit (26), install socket assemblies (20), snap rings (21) and hex nuts (17) on knuckle assemblies (13) and (24).
 - (7) Install knuckle assembly kit (12) and the following knuckle assembly kit (23) parts: adjusting split rings (14), slotted hex nuts (15) and cotter pins (16). Tighten adjusting split rings (14) and slotted hex nuts (15) to torque specified by table 6-2.
- f. Installation. Install front axle housing group as follows:
 - (1) Support axle housing assembly on hydraulic jack and position under vehicle.
 - (2) Refer to paragraph 5-5.5.3 and install front springs.
 - (3) Refer to paragraph 5-5.4.5 and install axle housing assembly on front springs using U-bolts and tie plates.
 - (4) Refer to paragraphs 5-5.7.6 and 5-5.7.7 and install front brake calipers and front brake disc.
 - (5) Refer to paragraph 5-5.5.2 and install stabilizer bar.
 - (6) Refer to paragraph 5.5.5.1 and install front shock absorbers.
 - (7) Refer to paragraph 5-5.4.5 and install tie rod.
 - (8) Refer to paragraph 5-5.7.2 and install front wheels.
 - (9) Loosen hex nuts (28).
 - (10) Using a turntable to measure angle adjust stop bolts (27) to obtain proper turning angle.
 - (11) To reduce the turning radius of this vehicle to a minimum of 17 feet the following procedures will be used:
 - a. Remove stop bolts (27) and hex nuts (28) from left and right steering knuckles.
 - b. Replace with identical bolt and hex nut combination in steering knuckles. Leave loose to allow for adjustments.
 - c. Adjust stop bolts (27) to achieve a minimum authorized turning radius of not less than 17 feet (measure center of turning circle to outer most wheel travel.)
 - d. Tighten hex nut (28) to prevent stop bolt from losing adjustment.

5-5.6 Rear Axle and Suspension.

5-5.6.1 *Rear Shock Absorber Group.* Refer to figure 5-124, and perform the following steps to overhaul the rear shock absorber group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the rear shock absorber assemblies as follows:
 - (1) Raise vehicle.
 - (2) Position hydraulic jack under axle and raise axle to relieve springs of axle weight.



- | | |
|---------------------------------|----------------|
| 1. Rear Shock Absorber Assembly | 4. Flat Washer |
| 2. Capscrew | 5. Bushing |
| 3. Self-Locking Nut | |

Figure 5-124. Rear Shock Absorber Group

- (3) Remove self-locking nuts (3) and flat washers (4) from top mounting pins.
- (4) Remove self-locking nuts (3) from cap screws (2) and remove cap screws (2).
- (5) Remove shock absorber assemblies (11) and remove bushings (5) from shock absorber mounting eyes.
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace worn out shock absorbers and any worn or damaged attaching parts.
- d. Installation. Install shock absorber assembly as follows:
 - (1) Install bushings (5) in shock absorber mounting eyes.

NOTE

Do not lubricate bushings before installing them in shock absorber mounting eyes.

- (2) Position shock absorbers on top mounting pins.
- (3) Install cap screws (2).
- (4) Install self-locking nuts (3) on cap screws (2) and tighten to torque prescribed by table 6-2.
- (5) Install flat washer (4) and self locking nuts (3) on top mounting pins and tighten to torque prescribed by table 6-2.
- (6) Lower axle, remove hydraulic jack and lower vehicle.

5-5.6.2 *Rear Spring Group.* Refer to Figure 5-125, and perform the following steps to overhaul the rear spring group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove rear spring group as follows:

WARNING

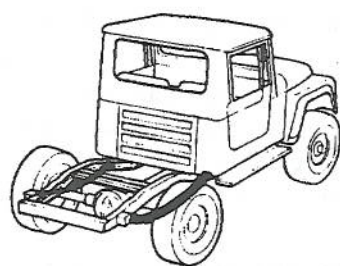
Do not work under raised vehicle without first supporting vehicle with safety jack stands or injury to personnel may occur.

- (1) Raise vehicle.
- (2) Support vehicle with safety jack stands under frame rails.

NOTE

Removal procedures for left and right spring groups are identical.

- (3) Position hydraulic jack under axle to relieve spring assembly of axle weight.
- (4) Disconnect shock absorber at axle.
- (5) Refer to paragraph 5-5.7.2 and remove rear wheel.
- (6) Remove hex nuts (14), lockwashers (15) and spring clips (13).
- (7) Remove plate (12).
- (8) Remove cap screw (2) and self-locking nut (3).
- (9) Remove cap screw (6), self-locking nut (7) and spring assembly (1).
- (10) Remove cap screw (9), self-locking nut (10) and shackle assembly (8).



- | | | |
|---------------------|----------------------|-----------------|
| 1. Spring Assembly | 6. Capscrew | 11. Bushing |
| 2. Capscrew | 7. Self-Locking Nut | 12. Plate |
| 3. Self-locking Nut | 8. Shackle Assembly | 13. Spring Clip |
| 4. Bushing | 9. Capscrew | 14. Hex Nut |
| 5. Rear Bushing | 10. Self-Locking Nut | 15. Lockwasher |

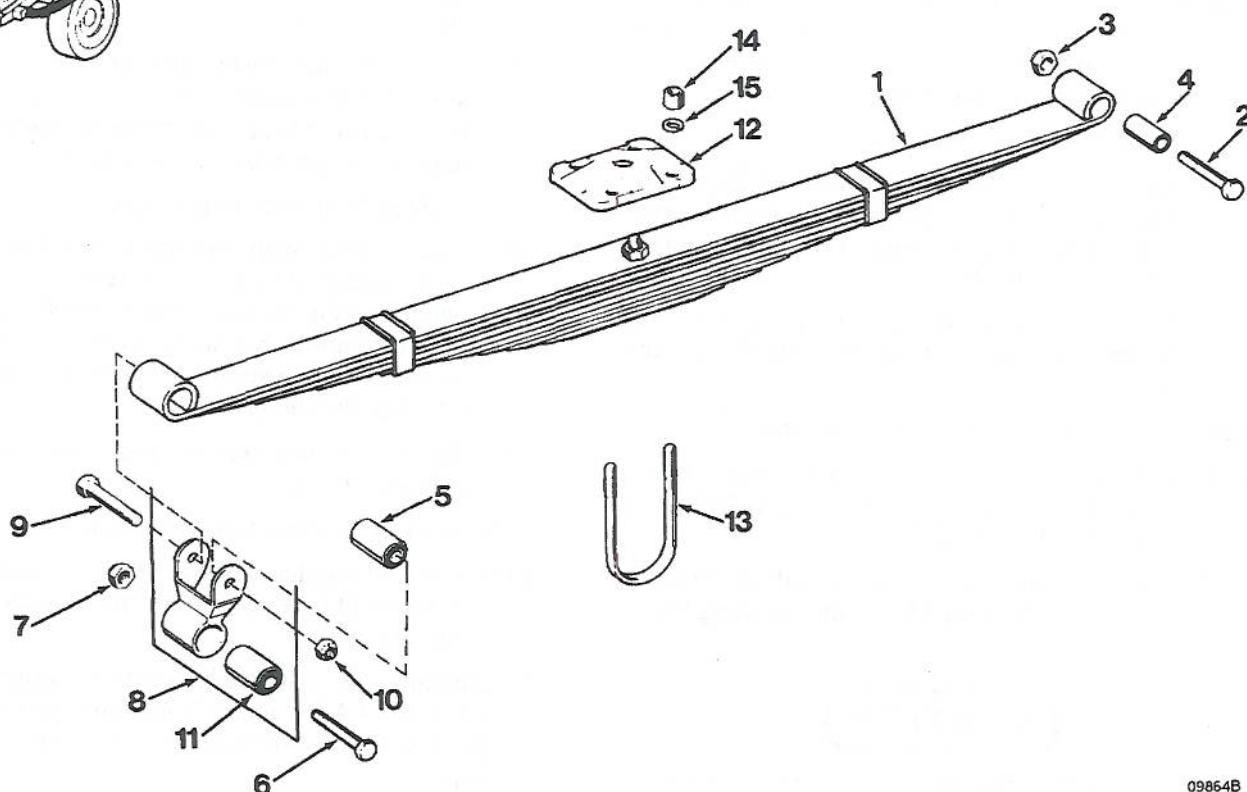


Figure 5-125. Rear Spring Group

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- (11) Refer to figure 5-126 to remove small bushing (4, figure 5-125) from rear spring as follows in steps (12) through (20).
- (12) Insert a 3/8 inch by 8 inch length of threaded rod through front bushing (4). Center bushing (4) on rod.

CAUTION

When removing bushing, press only on metal outer sleeve or damage to bushing may result.

- (13) Place a socket of diameter large enough to bear against metal outer sleeve of bushing (4), but small enough to pass through spring (1) eye, on one end of the threaded rod with the open end of the socket toward bushing (4). Socket will serve as bushing driver.
- (14) Install one flat washer and one hex nut on rod behind socket.

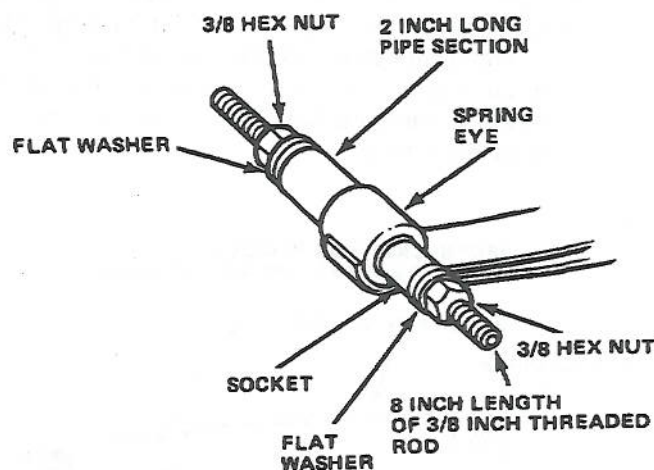


Figure 5-126. Bushing Replacement Tools-Small Bushing

- (15) Install 2 inch length of pipe with diameter large enough to accommodate bushing (4), but small enough to seat firmly against spring (1) eye, on opposite end of threaded rod. Pipe will serve as bushing receiver.
- (16) Install one flat washer and one hex nut on rod to hold pipe section in place. Flat washer must be of large enough diameter to support and maintain alignment of pipe section.
- (17) Tighten both hex nuts, finger tight.
- (18) Align socket with bushing (4) and align pipe with spring (1) eye. Socket will act as a press ram and press the bushing (4) out of the spring (1) eye and into the pipe.
- (19) Tighten nut at socket end of spring eye until bushing (4) is pressed out of spring (1) eye into pipe.
- (20) Remove bushing tools and bushing (4).
- (21) Refer to figure 5-127 and remove large bushing (5, figure 5-125) from rear spring as follows in steps (22) through (30).
- (22) Insert 1/2 inch by 11 inch length of threaded rod through bushing (5). Center bushing (5) on rod.

CAUTION

When removing bushing, press only on metal outer sleeve or damage to bushing may result.

- (23) Place deep socket of diameter large enough to bear against metal outer sleeve of bushing (5), but small enough to pass through spring (1) eye, on one end of threaded rod with open end of socket towards bushing (5). Socket will serve as bushing driver.

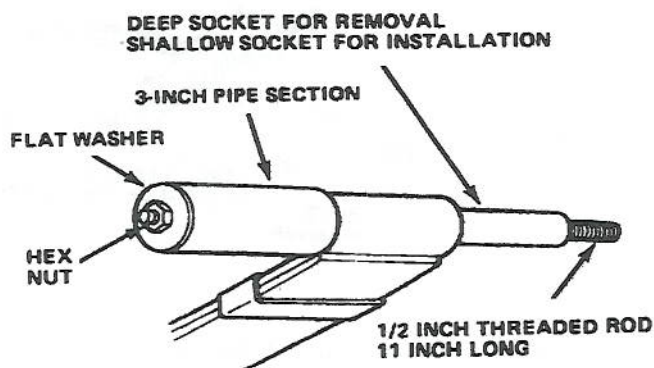


Figure 5-127. Bushing Replacement Tools
Large Bushing

- (24) Install one flat washer and one hex nut on rod behind socket.
- (25) Install a 3 inch length of pipe with diameter large enough to accommodate bushing (5), but small enough to seat firmly against spring (1) eye, on opposite end of threaded rod. Pipe will serve as bushing receiver.
- (26) Install one flat washer and one hex nut on rod to hold pipe section in place. Flat washer must be of large enough diameter to support and maintain alignment of pipe section.
- (27) Tighten both nuts, finger tight.
- (28) Align socket with bushing (5) and align pipe with spring (1) eye. Pipe section must butt against spring (1) eye surface so bushing (5) can pass through it. Socket will act as a press ram and press the bushing (5) out of the spring (1) eye and into the pipe.
- (29) Tighten nut at socket and press bushing (5) out of spring (1) eye.
- (30) Remove bushing tools and bushing (5).
- (31) Use method described in step (11) and remove bushing (11) from rear spring shackle assembly (8).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:

- (1) Inspect bushings (4), (5) and (11) for looseness in spring (1) eye or shackle assembly (8).
- (2) Inspect bushings (4), (5) and (11) for deterioration of bushing rubber.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly of the rear spring group is accomplished during installation. Install the rear spring group as follows:

WARNING

Do not work under raised vehicle without first supporting vehicle with safety jack stands or injury to personnel may occur.

NOTE

Installation procedures for left and right spring groups are identical.

- (1) Refer to figure 5-127 and install large bushing (5, figure 5-125) as follows in steps (2) through (10).

- (2) Center bushing (5) on 1/2 inch by 11 inch length of threaded rod. Slide 3 inch length of pipe over bushing (5). Pipe must be of diameter that will seat firmly against the spring (1) eye.



When installing bushings, press only on metal outer sleeve or damage to bushing may occur.

- (3) Place shallow socket of diameter small enough to pass through the pipe section, but large enough to bear against metal outer sleeve of bushing (5), on one end of threaded rod with open end of socket toward bushing (5). Socket will serve as bushing driver.
- (4) Install one flat washer and one hex nut on rod behind socket.
- (5) Insert rod through spring (1) eye. Seat pipe section firmly against spring (1) eye.
- (6) Install one flat washer and one hex nut on end of rod against spring (1) eye. Diameter of flat washer must exceed diameter of spring (1) eye.
- (7) Align socket with bushing (5) and align bushing (5) with spring (1) eye. The pipe section must butt against the spring (1) eye surface so bushing (5) can pass through it. Socket will act as a press ram and press the bushing (5) out of the pipe into the spring (1) eye.
- (8) Tighten nut at socket and press bushing (5) into spring (1) eye.
- (9) Loosen tools and check bushing (5) position. Bushing (5) must be centered in spring (1) eye. Ends of bushing (5) must be flush with or slightly inset from ends of spring (1) eye.
- (10) If bushing (5) is not centered, tighten tools and correct bushing (5) position. If it is centered, remove tools.
- (11) Use method described in steps (2) through (10) and install bushing (11) in shackle assembly (8).
- (12) Refer to figure 5-126 and install small bushing (4, figure 5-125) as follows in steps (13) through (21).
- (13) Center bushing (4) on 3/8 inch by 8 inch length of threaded rod. Slide 2 inch length of pipe over bushing (4). Pipe must be of diameter to seat firmly against spring (1) eye.



When installing bushing, press only on metal outer sleeve or damage to bushing may result.

- (14) Place socket of diameter small enough to pass through pipe, but large enough to bear against metal outer sleeve of bushing (4) on one end of threaded rod with open end of socket toward bushing (4). Socket will serve as bushing driver.
- (15) Install flat washer and hex nut on rod behind socket.
- (16) Insert rod through spring (1) eye. Seat pipe section firmly against spring (1) eye.
- (17) Install flat washer and hex nut on end of rod against spring (1) eye. Diameter of flat washer must exceed diameter of spring (1) eye.
- (18) Align socket with bushing (4) and align bushing (4) with spring (1) eye. The pipe section must butt against the spring (1) eye surface so bushing (4) can pass through it. Socket will act as a press ram and press the bushing (4) out of the pipe into the spring (1) eye.
- (19) Tighten nut at socket and press bushing (4) into spring (1) eye.
- (20) Loosen tools and check bushing (4) position. Bushing (4) must be centered in spring (1) eye. Ends of bushing (4) must be flush with, or slightly inset from, ends of spring (1) eye.
- (21) If bushing (4) is not centered in spring (1) eye, tighten tools and correct bushing (4) position. If bushing (4) is centered, remove tools.
- (22) Install shackle assembly (8), capscrew (9) and self-locking nut (10) to spring assembly (1). Do not tighten capscrew (9).
- (23) Install one end of spring assembly (1) with capscrew (6) and self-locking nut (7). Do not tighten capscrew (6).
- (24) Install the other end of spring assembly (1) with capscrew (2) and self-locking nut (3). Do not tighten capscrew (2).
- (25) Install plate (12).
- (26) Position axle on spring assembly (1) and install two spring clips (13), four lockwashers (15) and four hex nuts (14). Tighten hex nuts (14) to torque specified in table 6-2.

- (27) Connect shock absorber to axle.
- (28) Refer to paragraph 5-5.2 and install wheels.
- (29) Remove hydraulic jack from under axle.
- (30) Tighten capscrews (2), (6) and (9) to torque specified in table 6-2.
- (31) Remove safety stands from under frame rails.
- (32) Lower vehicle.

5-5.6.3 *Rear Axle Assembly and Rear Differential Group*. Refer to figure 5-128, and perform the following steps to overhaul the rear axle assembly and rear differential group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove rear axle assembly and rear differential group as follows:

WARNING

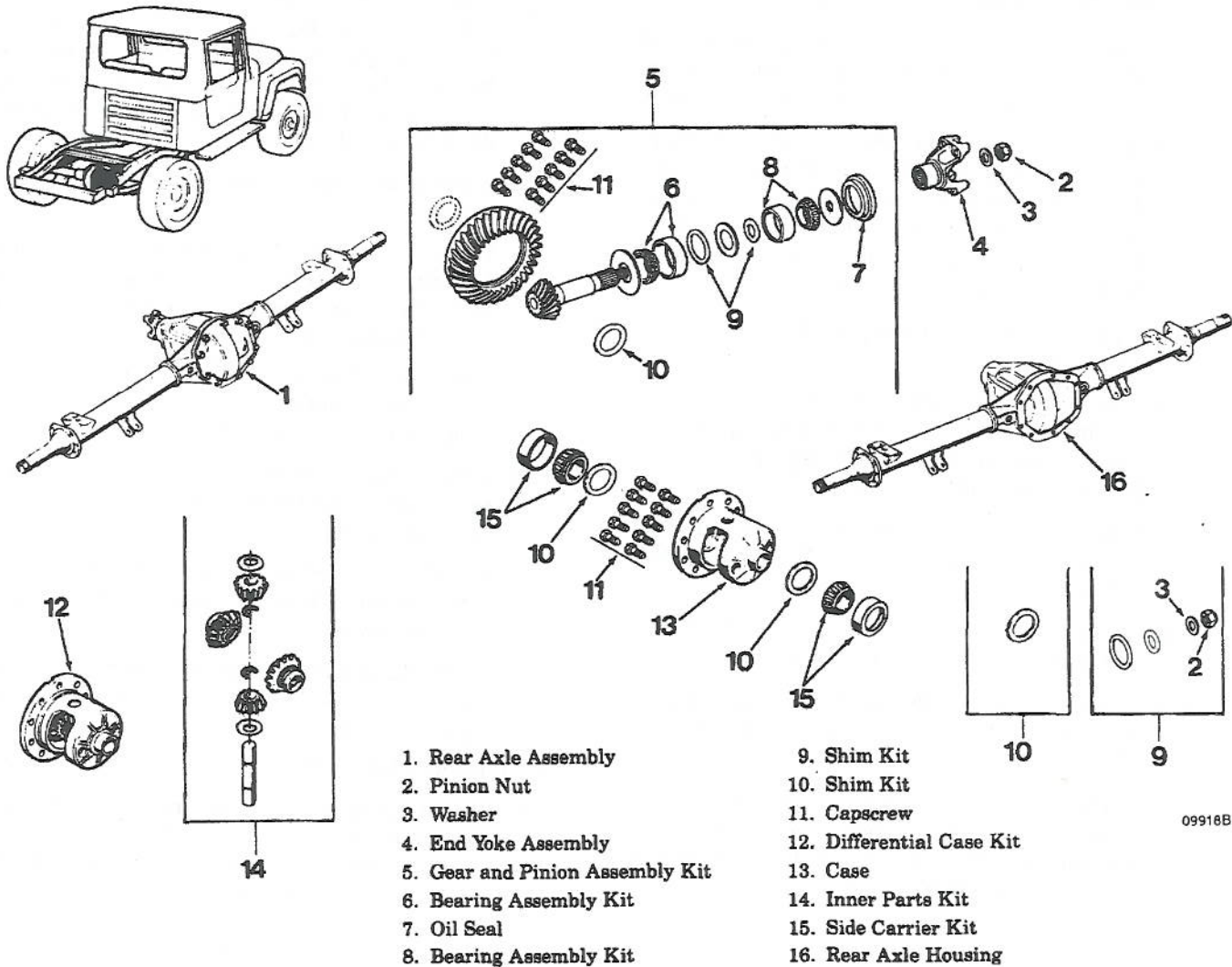
Do not work under raised vehicle without first supporting vehicle with safety jack stands or injury to personnel may occur.

- (1) Refer to paragraph 4-4.14 and drain rear axle fluid.
- (2) Refer to paragraph 5-5.6.5 and remove rear axle shafts.

NOTE

Lower left spring at front shackle so spreader tool can be installed.

- (3) Refer to paragraph 5-5.6.1 and remove rear shock absorbers at one end only.
- (4) Refer to paragraph 5-5.6.2 and remove U-bolts and tie plate.



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Figure 5-128. Rear Axle Assembly and Rear Differential Group

- (5) Loosen nuts attaching rear spring shackle to spring.
 - (6) Support axle housing with jack stand.
 - (7) Remove bolts attaching spring shackle to spring and lower spring.
 - (8) Remove axle housing cover from rear axle assembly (1).
 - (9) Mark carrier caps (2, figure 5-133) for assembly reference.
 - (10) Loosen, but do not remove, differential bearing cap bolts.
 - (11) Install spreader tool #J-24385-01 (figure 5-129). Be sure to install holddown clamps to keep spreader tool in position.
 - (12) Mount dial indicator on axle housing (16, figure 5-128). Zero indicator and be sure indicator stylus contacts one side of opening in housing (1).
 - (13) Spread housing no more than figure given in table 6-1. Remove dial indicator.
 - (14) Remove carrier caps. Tag caps for assembly reference.
 - (15) Remove differential case kit (12).
 - (16) Remove and discard capscrews (11).
 - (17) Remove ring gear from differential case (13).
 - (18) Remove inner parts kit (14).
 - (19) Remove side carrier kits (15) and shims (10).
 - (20) Mark propeller shaft and end yoke assembly (4) for assembly reference.
 - (21) Remove and discard pinion nut (2) using tool #J-8614-01 and washer (3).
 - (22) Remove end yoke assembly (4) using tools #J-8614-01, #J-8614-02, and #J-8614-03 (figure 5-130).
 - (23) Remove dust cap from pinion gear.
 - (24) Remove pinion gear.
 - (25) Remove shims (9, figure 128) and (10), bearing assembly kits (6) and (8) and oil seal (7).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:

WARNING

P-D-680 Type II is toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Good general ventilation is normally adequate.

Compressed air used for cleaning purposes can generate airborne particles which may enter the eyes. Pressure shall not exceed 30 psi and goggles must be worn.

- (1) Clean all parts with P-D-680 Type II (7, table 5-1). Allow bearings to air dry. Dry other parts with compressed air.

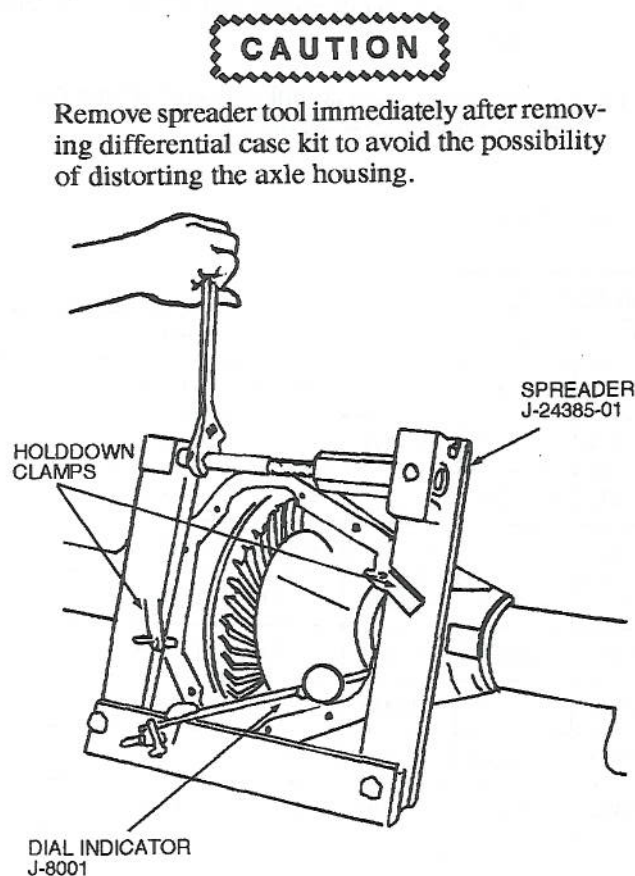


Figure 5-129. Spreading Axle Housing

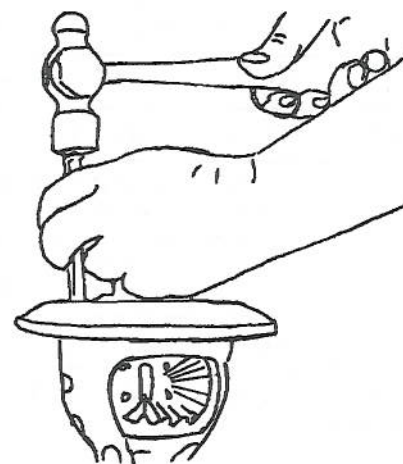


Figure 5-130. Pinion Yoke Removal

- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install rear axle assembly and rear differential group as follows:
 - (1) Measure thickness of shim kits (9) and (10) removed during disassembly.
 - (2) Note pinion depth variance numbers on old and new pinion gears.
 - (3) Refer to table 5-8, and determine amount to be added to or subtracted from original shim to arrive at starter shim thickness.
 - (4) Install pinion front bearing cup in housing bore, using driver handle #J-7079-02 and installer #J-25101.
 - (5) Install starter shim in rear bearing bore at rear axle housing (16). Be sure shim is centered in cup bore. If shim is chamfered, chamfer must face toward housing bore, not toward pinion head.
 - (6) Install pinion rear bearing cup in housing bore, using driver handle #J-25122 and installer #J-25157.
 - (7) Install bearing assembly (6) using installer sleeve #J-24433.
 - (8) Install pinion gear in rear axle housing (16).
 - (9) Install bearing assembly kit (8).

- (10) Install bearing assembly (8), end yoke assembly (4), washer (3) and pinion nut (2). Tighten nut (2) only enough to remove end play and provide 10 to 15 inch-pounds of drag torque when pinion is rotated.

- (11) Note pinion depth variance marked on pinion gear. If number is preceded by a plus (+) sign, add that amount to standard setting for rear axle assembly (1). If number is preceded by a minus (-) sign, subtract that amount from standard setting. Record this figure for future reference.

NOTE

If gear is marked 0 (zero), use the standard setting.

- (12) Assemble gauge arbor #J-5223-4 and discs #J-5223-25 (figure 5-131), and install in differential bearing cup bores. Be sure discs are firmly seated in bearing cup bores.
- (13) Install carrier caps over discs and tighten cap bolts securely.
- (14) Remove standard plunger from gauge block #J-5223-20 and install plunger #J-5223-27 (figure 5-132).
- (15) Compress plunger completely and tighten gauge block thumbscrew securely.

Table 5-8. Pinion Variance Chart

Old Pinion Marking	New Pinion Marking								
	-4	-3	-2	-1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0.000
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003
0	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004
-1	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005
-2	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006
-3	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007
-4	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007	-0.008

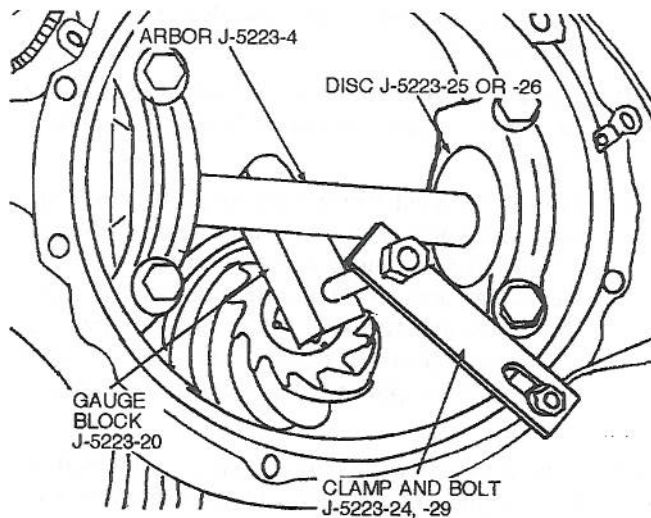


Figure 5-131. Installing Pinion Depth Gauge Tools

- (16) Install gauge block #J-5223-20. Position block so plunger is directly under gauge arbor #J-5223-4 (figure 5-131) and flat surface on anvil side of block.

CAUTION

To avoid false reading, do not allow the anvil to contact the pinion gear at any point.

- (17) Assemble bolt #J-5223-29 and clamp #J-5223-24 and mount tools on rear axle housing (16, figure 5-128). Use bolts to attach clamp to rear axle housing (16).
- (18) Extend clamp bolt until it presses against gauge block. Align gauge block plunger with center of gauge arbor and tighten clamp bolt until it presses against block with enough force to prevent block from moving.

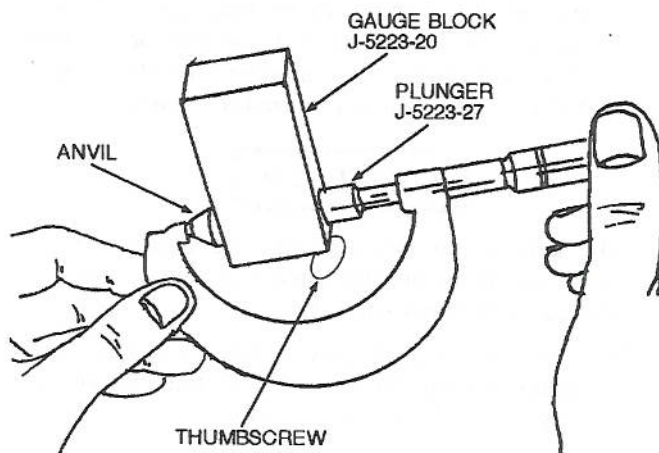


Figure 5-132. Measuring Gauge Block

- (19) Loosen gauge block thumbscrew and release plunger. When plunger contacts arbor tool, tighten thumbscrew to lock plunger in position. Do not disturb plunger position.
- (20) Remove clamp and bolt from rear axle housing (16).
- (21) Remove gauge block and measure distance from end of anvil to end of plunger using 3 inch micrometer (figure 5-132). This dimension represents measured pin depth. Record this measurement for assembly reference.

NOTE

If the measured pinion depth equals the desired pinion depth, the installed shim thickness is correct and further adjustment is not required.

- (22) Remove carrier caps and remove arbor tool and discs. If shim thickness and pinion depth are correct, proceed to step (25).
- (23) Remove pinion gear, rear bearing cup and depth shim from rear axle housing (16, figure 128).
- (24) Measure thickness of depth shim just removed from rear axle housing (16) and add this dimension to measured pinion depth obtained in previous step. From this total, subtract desired pinion depth. Result represents shim thickness required to adjust pinion depth.
- (25) To make pinion bearing preload adjustment, install previously used shims (9).
- (26) Reinstall pinion gear, bearing assembly kit (8), end yoke assembly (4), washer (3) and pinion nut (2). Tighten nut slowly to ensure that bearings are not over preloaded. If bearing preload is too great with less than torque given in table 6-2, the shim kit (8) is too thin.
- (27) Measure torque required to rotate pinion gear using 0-5 inch-pound torque wrench. Rotating torque should be between figures specified by table 6-2. Add shims to decrease preload. Subtract shims to increase preload.
- (28) Remove old pinion nut (2) and install new nut when pinion bearing preload is correctly adjusted.
- (29) Tighten pinion nut to torque specified by table 6-2.

- (30) To adjust differential bearing preload and ring gear backlash, remove all shims (10) from differential case kit (12) if not removed previously.
 - (31) Install side carrier kits (15).
 - (32) Install differential case kit (12) in axle housing.
 - (33) Install carrier caps and tighten bolts securely, but not to torque specified by table 6-2.
 - (34) Mount dial indicator #J-8001 to contact the ring gear carrier mating surface and accurately measure total carrier side movement.
 - (35) To measure side movement, position a screwdriver behind one bearing cup and force carrier away from dial indicator as far as possible.
 - (36) Zero dial indicator.
 - (37) Position screwdriver behind opposite side bearing cup and force carrier as far as possible toward dial indicator. Repeat operation to ensure correct reading.
 - (38) Record reading for later use.
 - (39) Mount dial indicator on ring gear side of carrier flange and check flange runout with screwdriver held tightly against bearing cup.
 - (40) Replace carrier if flange runout exceeds figure specified by table 6-2.
 - (41) Remove case (13).
 - (42) Install ring gear on case (13) using new capscrews (11) in ring gear 180 degrees apart. This will ensure proper hole alignment. Tighten capscrew (11) to torque specified by table 6-2.
 - (43) Use feeler gauge to check that clearance between ring gear and carrier flange is figure specified by table 6-1. If clearance exceeds this figure, loosen capscrews and move ring gear away from flange. Use compressed air to remove dirt or metal particles lodged behind ring gear.
 - (44) Retighten capscrews (11) and recheck clearance. If clearance is the figure specified in table 6-1, tighten capscrews to torque specified by table 6-1.
 - (45) Install case (13) and bearing cups into housing and install carrier caps and screws.
- Tighten capscrews tight enough to hold carrier caps straight.
 - (46) Mount dial indicator #J-8001 on thrust side of carrier case flange so dial indicator will contact flange.
 - (47) Position screwdriver behind thrust bearing cup; move ring gear teeth into pinion gear and hold. Ensure that dial indicator is in contact with carrier flange and zero dial indicator. Move screwdriver to opposite side behind carrier bearing cup (coast side) and move differential as far as possible from pinion gear. Record dial indicator reading.
 - (48) Repeat procedure to ensure proper dial indicator reading. This measurement is thickness of shim kit to be placed on back side of thrust bearing between bearing and carrier. The balance of total distance of measurement is recorded in step (38).
 - (49) Remove differential case kit (12) and remove bearing assemblies (15) using bearing removal tool #J-29721.
 - (50) Measure and install correct shim pack thickness behind coast side bearing and install bearing.
 - (51) Use feeler gauge to check that clearance between bearings and shim pack and carrier bearing wall is figure specified by table 6-1.
 - (52) Remove front axle inner oil seals using splined end of axle shaft to pry out seals. Install new seals using installer #J-28648.
 - (53) Install differential case kit. Tighten carrier capscrews to torque specified by table 6-2. Seal threads with RTV sealer (24, table 5-1).
 - (54) Mount dial indicator #J-8001 and check backlash. Check backlash in three places, 120 degrees apart. If backlash is not within figures specified by table 6-1, remove differential case (13). Remove side carrier kit (15) and add or subtract shims (10) from differential bearing shim packs to move ring gear to required backlash.



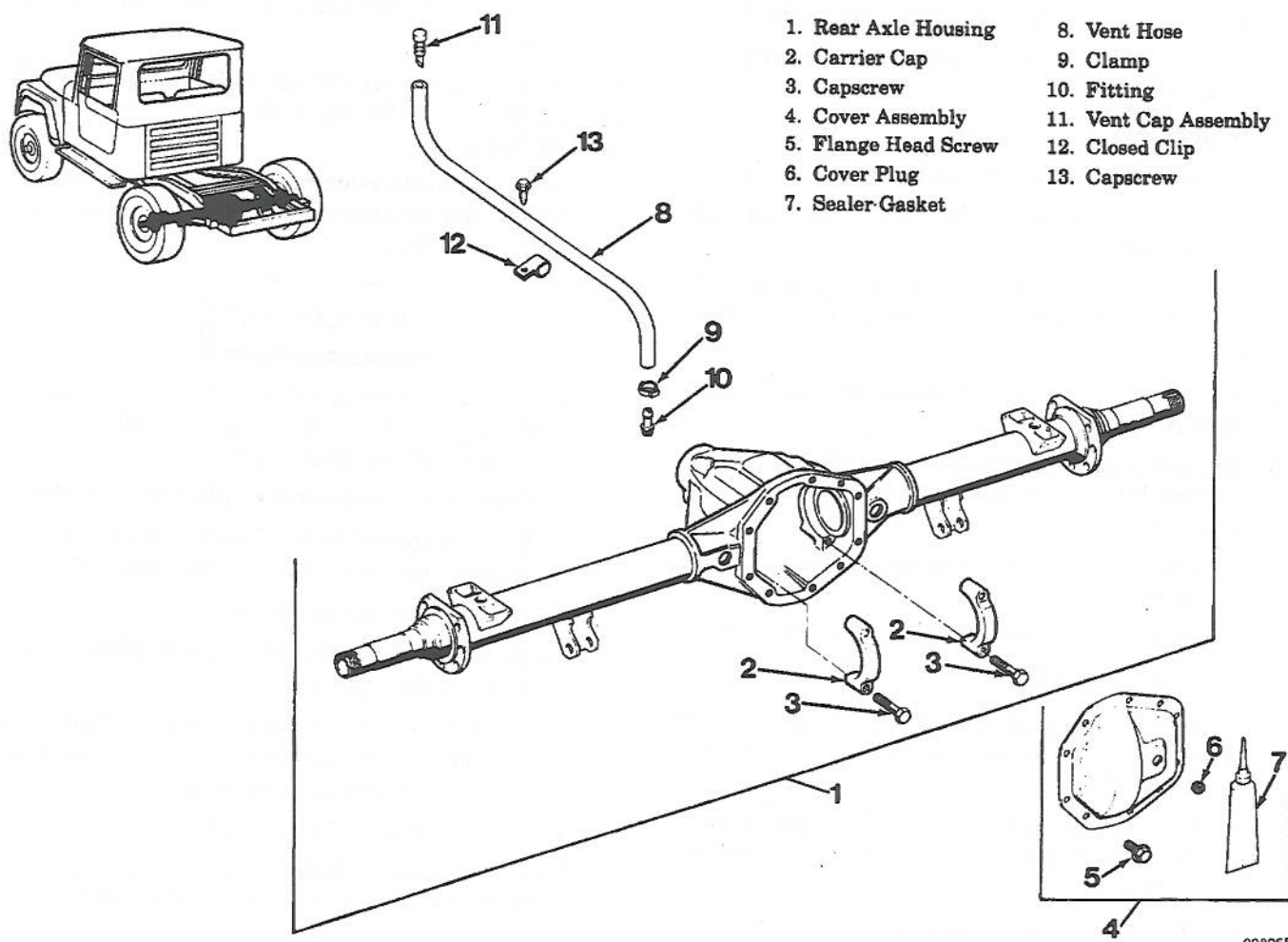
The same amount of shim thickness added or subtracted from one side must be added or subtracted on the opposite side.

- (55) Lubricate all bearings with grease and gears with gear lubricant (26, table 5-1). Rotate pinion gear to prelube all moving components.

- (56) Install axle housing cover. Clean cover and housing mating surfaces and apply thin bead of silicone sealer (24, table 5-1) to housing and cover before installation.
- (57) Raise spring and install front spring shackles to spring attaching bolts.
- (58) Remove jack stand.
- (59) Refer to paragraph 5-5.6.2 and install tie plates and U-bolts. Tighten U-bolts to torque specified by table 6-2.
- (60) Tighten spring shackle to spring attaching bolts to torque specified in table 6-2.
- (61) Refer to paragraph 5-5.6.1 and install rear shock absorbers.
- (62) Refer to paragraph 5-5.6.5 and install rear axle shafts.

5-5.6.4 *Rear Axle Housing Group*. Refer to figure 5-133 and perform the following steps to overhaul the rear axle housing group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove rear axle housing group as follows:
 - (1) Raise vehicle and position support stands under frame rails just forward of rear springs.
 - (2) Refer to paragraph 5-5.7.2 and remove rear wheels.
 - (3) Mark propeller shaft and axle for assembly alignment reference.
 - (4) Disconnect propeller shaft at rear axle yoke.



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Figure 5-133. Rear Axle Housing Group

- (5) Refer to paragraph 5-5.6.1 and disconnect shock absorbers at axle tubes.
- (6) Remove clamp (9) and vent hose (8) from fitting (10).
- (7) Remove fitting (10) from rear axle housing (1).
- (8) Remove capscrew (13) and remove closed clip (12) from vehicle.
- (9) Remove closed clip (12) and vent cap assembly (11) from vent hose (8).
- (10) Disconnect parking brake cable.

NOTE

Remove all braces, wires and tie wraps, as necessary, to remove rear axle housing.

- (11) Support rear axle housing (1) using hydraulic jack.
 - (12) Remove U-bolts.
 - (13) Slide rear axle housing from under vehicle.
 - (14) Remove flange head screws (5) and cover assembly (4).
 - (15) Remove cover plug (6).
 - (16) Remove capscrews (3) and carrier cap (2).
 - (17) Refer to paragraph 5-5.6.3 and remove rear axle assembly.
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install rear axle housing group as follows:
- (1) Refer to paragraph 5-5.6.3 and install rear axle assembly.
 - (2) Install carrier caps (2) using capscrews (3).
 - (3) Install cover plug (6).
 - (4) Apply sealer gasket (7) to cover assembly (4) and install cover assembly (4) using flange head screws (5).
 - (5) Position rear axle housing (1) under vehicle, aligning springs with axle spring pads, and install U-bolts.
 - (6) Connect parking brake cable.
 - (7) Install closed clip (12) and vent cap assembly (11) on vent hose (8).

- (8) Install fitting (10) in rear axle housing (1).
- (9) Install clamp (9) on vent hose (8) and install vent hose (8) on fitting (10). Tighten clamp.
- (10) Install closed clip on vehicle using capscrews (13).

NOTE

Install all hoses, wires and tie wraps which were removed.

- (11) Refer to paragraph 5-5.6.1 and connect shock absorbers at axle tubes.
- (12) Install propeller shaft. Align reference marks made during removal.
- (13) Bleed and adjust rear brakes.
- (14) Refer to paragraph 5-5.7.2 and install rear wheels.
- (15) Remove supports and lower vehicle.
- (16) Check axle lubricant level. Add lubricant as necessary.

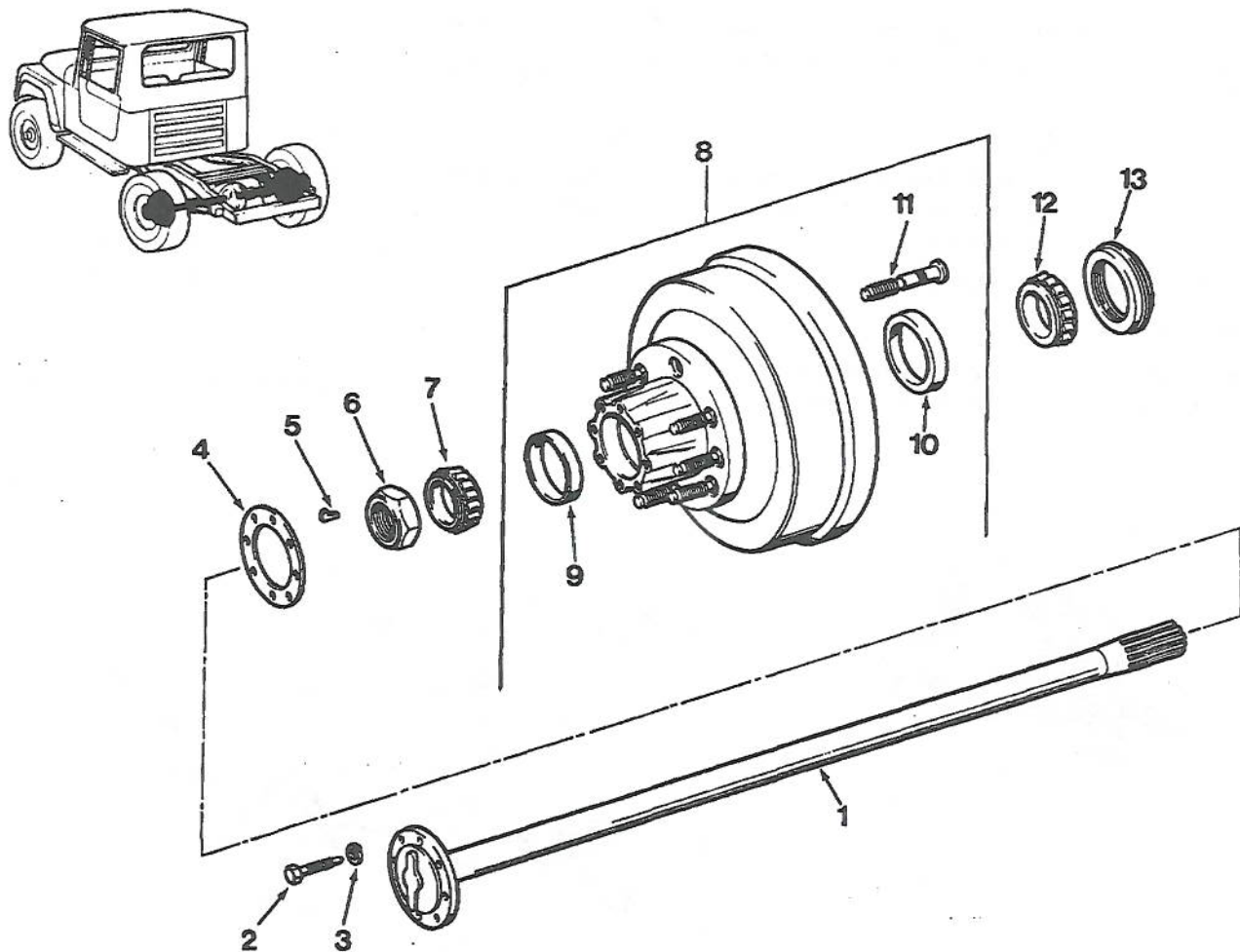
5-5.6.5 Rear Axle Shafts Group. Refer to figure 5-134, and perform the following steps to overhaul the rear axle shafts group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove rear axle shafts group as follows:

WARNING

Do not work under raised vehicle without first supporting vehicle with safety jack stands or injury to personnel may occur.

- (1) Raise vehicle and remove right wheel and drum.
- (2) Remove special bolts (2) and lockwashers (3); remove right axle shaft (1) and gasket (4).
- (3) Remove locking wedge (5).
- (4) Remove hex nut (6), bearing assembly (7) and outer bearing cup (9).
- (5) Remove hub part of hub and drum assembly (8) and remove retainer assembly (13), bearing assembly (12) and inner bearing cup (10).
- (6) Remove studs (11) from hub.
- (7) Follow same procedure when removing left rear axle shaft group components from left side of vehicle.



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- | | |
|---------------------|--------------------------|
| 1. Right Axle Shaft | 8. Hub and Drum Assembly |
| 2. Special Bolt | 9. Outer Bearing Cap |
| 3. Lockwasher | 10. Inner Bearing Cup |
| 4. Gasket | 11. Stud |
| 5. Locking Wedge | 12. Bearing Assembly |
| 6. Hex Nut | 13. Retainer Assembly |
| 7. Bearing Assembly | |

Figure 5-134. Rear Axle Shafts Group

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install axle shaft

group as follows:

- (1) Install studs (11) in hub part of hub and drum assembly (8).
- (2) Install inner bearing cup (10), bearing assembly (12) and retainer assembly (13).
- (3) Install hub.

- (4) Install outer bearing cap (9), bearing assembly (7) and hex nut. Tighten hex nut to torque specified by table 6-2.
- (5) Install locking wedge (5).
- (6) Install gasket (4) and right axle shaft (1) using special bolts (2) and lockwashers (3). Tighten bolts (2) to torque specified by table 6-2.
- (7) Install drum and right wheel.
- (8) Lower vehicle.
- (9) Follow same procedure when installing left rear axle shaft group components on left side of vehicle.

5-5.7 Brakes and Wheels.

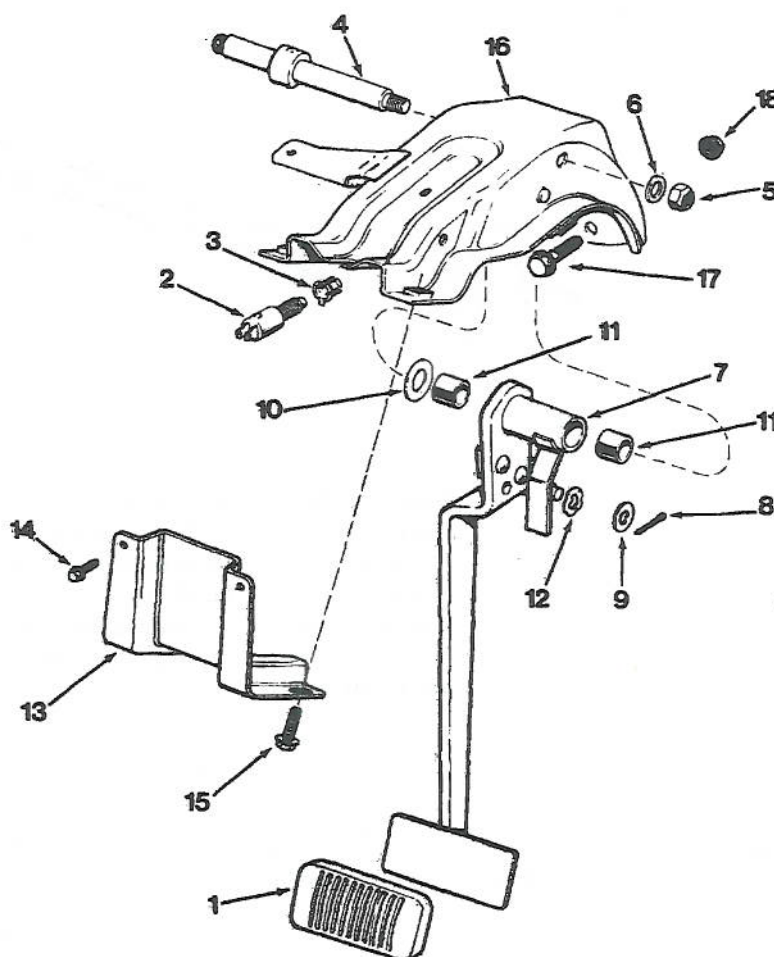
5-5.7.1 *Brake Pedal and Linkage Group*. Refer to figure 5-135, and perform the following steps to overhaul brake pedal and linkage group.

- a. Removal. Remove brake pedal and linkage group as follows:

- (1) Remove machine screws (15) and screws and washers (14); remove stabilizer bracket assembly (13).
- (2) Remove capscrews (17) and hex nuts (18); remove bracket (16) and brake pedal assembly (7).



1. Cover
2. Switch
3. Retainer
4. Brake Shaft Assembly
5. Self-Locking Hex Nut
6. Flat Washer
7. Brake Pedal Assembly
8. Cotter Pin
9. Flat Washer
10. Lockwasher
11. Pedal Bearing
12. Lockwasher
13. Stabilizer Bracket Assembly
14. Screw With Washer
15. Machine Screw
16. Bracket
17. Capscrew
18. Hex Nut



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Figure 5-135. Brake Pedal and Linkage Group

b. Disassembly. Disassemble brake pedal and linkage as follows:

- (1) Remove cotter pin (8), flat washer (9) and lockwasher (12).
- (2) Remove self-locking hex nut (5), flat washer (6) and brakeshaft assembly (4).
- (3) Remove brake pedal assembly (7).
- (4) Remove lockwasher (10) and pedal bearings (11).
- (5) Remove cover (1).
- (6) Remove switch (2) and retainer (3).

c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

d. Repair and replacement. Replace all worn or damaged parts.

e. Assembly. Assemble brake pedal and linkage as follows:

- (1) Install switch (2) and retainer (3).
- (2) Install cover (1).

(3) Install lockwasher (10) and pedal bearings (11).

(4) Install brake pedal assembly (7) on brake shaft assembly (4) and install brake shaft assembly (4) in bracket (16).

(5) Install flat washer (6) and self-locking nut (5).

(6) Install lockwasher (12), flat washer (9) and cotter pin (8).

f. Installation. Install brake pedal and linkage group as follows:

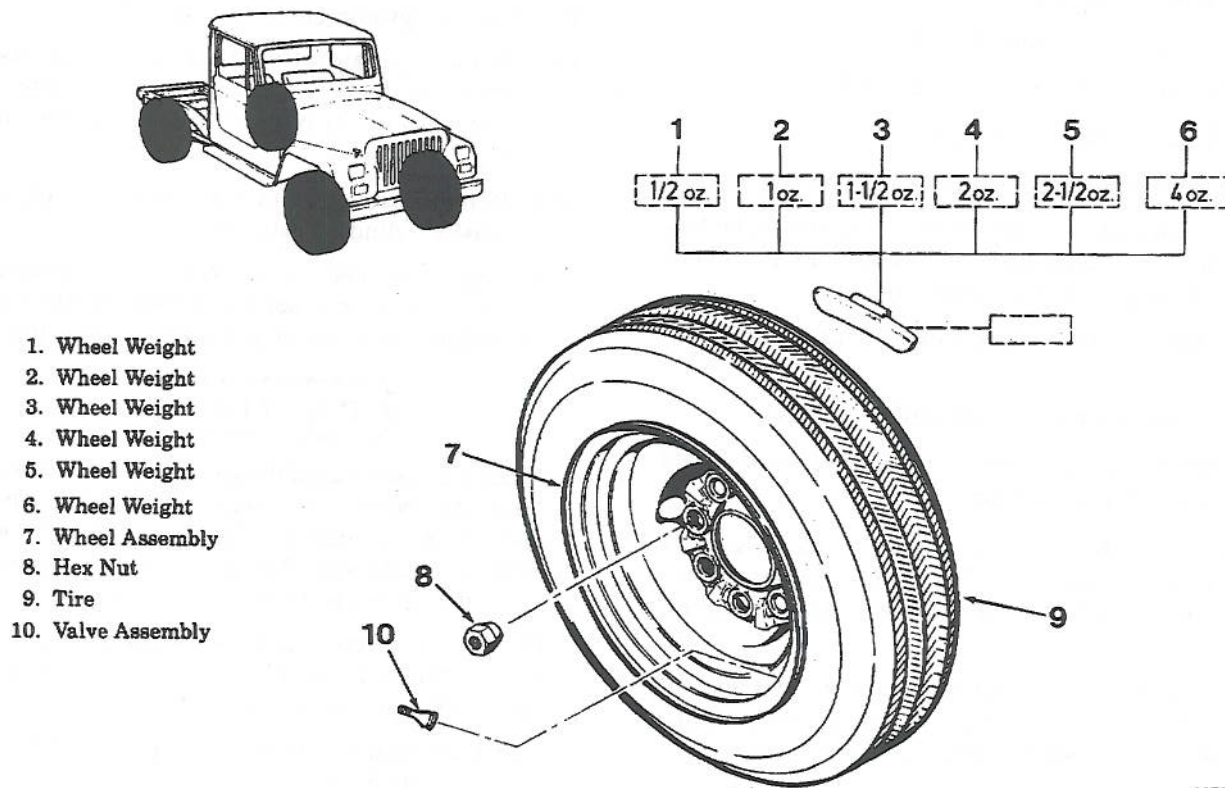
(1) Install bracket (16) using capscrew (17) and hex nut (18).

(2) Install stabilizer bracket (13) using screws and washers (14) and machine screw (15).

5-5.7.2 *Tire, Wheel and Weights Group*. Refer to figure 5-136, and perform the following steps to overhaul the tire, wheel and weights group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove tire, wheel and weights group as follows:

- (1) Remove hex nuts (8).



09788B

Figure 5-136. Tire, Wheel and Weights Group

- (2) Remove wheel assemblies (7).
- (3) Remove any old weights (1-6).
- (4) Remove tires (9).
- (5) Remove valve assemblies (10).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:

- (1) Inspect wheels for dents, cracks and broken welds. If wheel is found to be damaged, it must be replaced.



Never clean wheels with abrasives or caustic materials as damage to wheels may result.

- (2) Clean wheels with mild soap and water.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install tire, wheel and weights group as follows:
 - (1) Install valve assemblies (10).
 - (2) Install tires (9) on wheel assemblies (7).
 - (3) Install wheel (7) on hub.
 - (4) Install hex nut (8). Tighten to finger tightness.
 - (5) Tighten one hex nut (8) to torque prescribed by table 6-2, then tighten opposite hex nut (8) to torque prescribed by table 6-2.
 - (6) Tighten remaining hex nuts (8) in similar fashion.
 - (7) Install other wheels in similar fashion.
 - (8) Install wheel weights (1-6) as required by wheel balancing procedures.

5-5.7.3 Power Brake Booster And Master Cylinder Group. Refer to figure 5-137, and perform the following steps to the power brake booster and master cylinder group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove power brake booster and master cylinder group as follows:

- (1) Disconnect power unit push rod at brake pedal. Discard screw and nut attaching rod to pedal.

- (2) Remove hex nuts (17) and (19) and remove booster spacer (18) and booster (16) from vehicle.
- (3) Remove retainer strap (15), loosen hose clamp (14) and remove hose (13) from valve assembly (11). Remove hose clamp (14) from hose (13).
- (4) Remove hex nuts (2) and remove booster (16) from master cylinder body (9). Set master cylinder body (9) aside.
- (5) Remove valve assembly (11) and grommet (12) from booster (16).
- (6) Remove studs (20) from booster (16).
- (7) Disconnect brake lines at master cylinder body (9). Block cylinder ports and open ends of brake lines to prevent entry of dirt.
- (8) Remove master cylinder assembly (1) from vehicle.
- (9) Remove cover (3) and diaphragm (4) and drain brake fluid out of reservoir.
- (10) Mount master cylinder body (9) in vise and remove reservoir and grommet kit (5) using pry bar.
- (11) Remove grommets from reservoir.
- (12) Remove repair kit (7) by first pushing inward on its primary piston and removing snap ring from groove in bore of master cylinder body (9).
- (13) Remove seat (8) and valve assembly (6) from master cylinder body (9).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following step:



Clean the master cylinder assembly with brake fluid only. Never use solvents containing mineral oil such as gasoline, kerosene, alcohol or carbon tetrachloride. Mineral oil is very harmful to the rubber piston cups and seals.

Do not use wire to open a clogged port in the master cylinder assembly as wire may create burrs in the port and cylinder bore.

- (1) Clean master cylinder assembly in brake fluid (27, table 5-1).
- (2) Blow out all passages with compressed air.

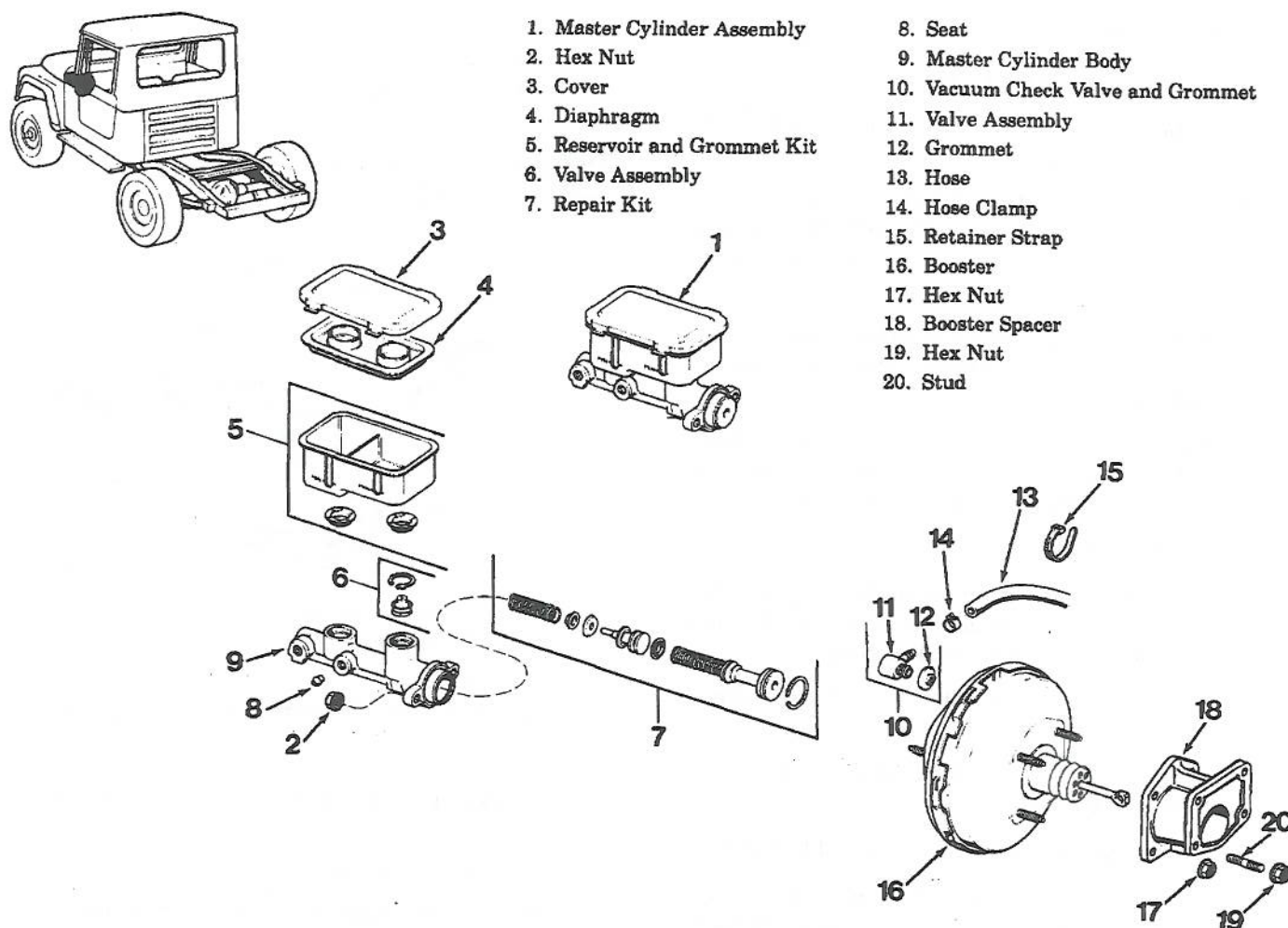


Figure 5-137. Power Brake Booster and Master Cylinder Group

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi and goggles must be worn.

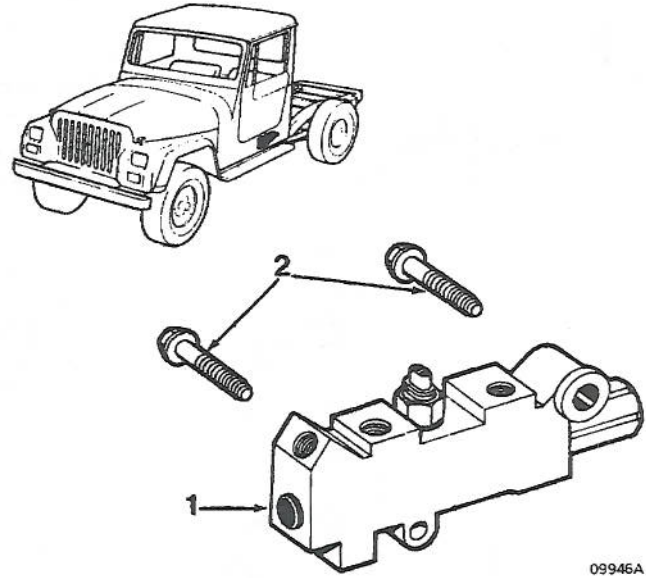
c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install power booster and master cylinder group as follows:

- (1) Install new seats (8) using spare tube fitting nuts to press them into place. Do not allow seats to become cocked during installation and be sure they are bottomed.
- (2) Assemble components of secondary piston of repair kit (7).

- (3) Lubricate bore of master cylinder body (9) with brake fluid and install secondary piston assembly.
- (4) Lubricate primary piston assembly of repair kit (7) with brake fluid and install in master cylinder body (9).
- (5) Push primary piston inward and install snap ring in groove of master cylinder bore.
- (6) Install new grommets from reservoir and grommet kit (5) in master cylinder body (9). Be sure grommets are properly seated.
- (7) Install valve assembly (6) in master cylinder body (9).
- (8) Lay reservoir from reservoir and grommet kit (5) or flat, hard surface. Press reservoir (5) into master cylinder body (9) using rocking motion.

- (9) Install diaphragm (4) in cover (3).
- (10) Install studs (20) in booster (16).
- (11) Install grommet (12) and valve assembly (11) in booster (16).
- (12) Install booster (16) and booster spacer (18) on vehicle using hex nuts (17) and (19). Tighten hex nuts (17) and (19) to torque specified in table 6-2.
- (13) Install master cylinder assembly (1) on booster using hex nuts (2). Tighten hex nuts to torque specified in table 6-2.
- (14) Install hose clamp (14) on hose (13). Install hose (13) on valve assembly (11) and tighten hose clamp (14). Install retainer strap (15).
- (15) Connect brakelines.
- (16) Align power unit push rod and brake pedal; install replacement attaching screw and nut and tighten to torque specified in table 6-2.
- (17) Add brake fluid to master cylinder reservoir to bring fluid to proper level.
- (18) Install cover (3) and diaphragm (4) on master cylinder reservoir.
- (19) Refer to paragraph 4-4.5 and bleed brakelines.



1. Brake Proportioning Valve
2. Capcrew

Figure 5-138. Brake Proportioning Valve Group

5-5.7.4 *Brake Proportioning Valve Group.* Refer to figure 5-138, and perform the following steps to overhaul the brake proportioning valve group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the brake proportioning valve group as follows:
 - (1) Disconnect brake lines from brake proportioning valve (1). Tape brake lines off to prevent leakage of brake fluid and contamination.
 - (2) Disconnect wire from switch.
 - (3) Remove capscrows (2).
 - (4) Remove brake proportioning valve (1).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install brake proportions valve as follows:
 - (1) Install brake proportioning valve (1) using capscrows (2).

- (2) Connect brake lines to brake proportioning valve (1).
- (3) Connect wire to switch.
- (4) Refer to paragraph 4-4.5 and bleed brake lines and refill master cylinder.

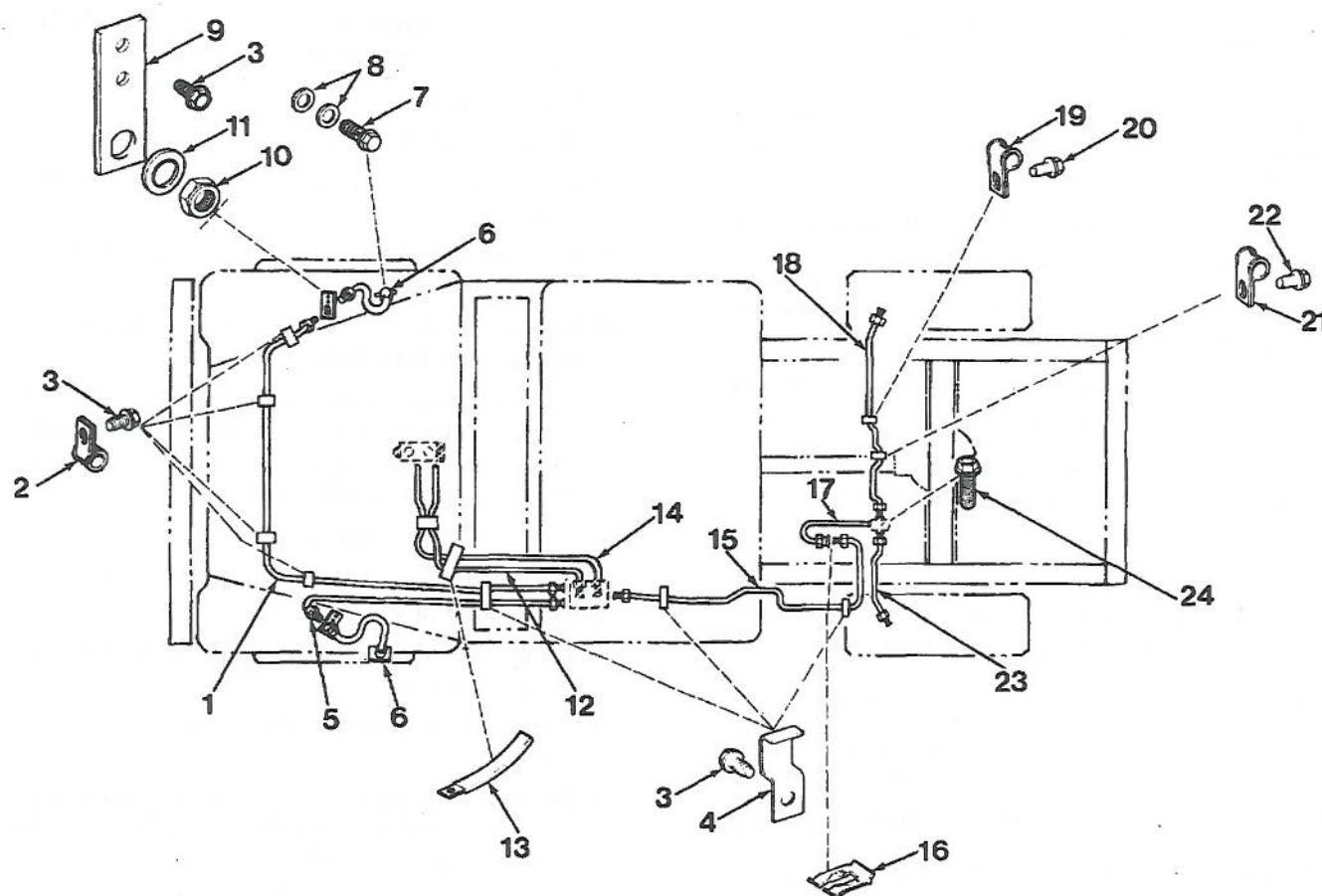
5-5.7.5 *Brake Lines Group.* Refer to figure 5-139, and perform the following steps to overhaul the brake lines group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove brake lines group as follows:

NOTE

Before removing any brake lines, bleed the system dry.

- (1) Remove capscrows (3), loosen connector, and remove hex nut (10), flat washer (11), and tube assembly (1).
- (2) Remove closed clips (2) and holddown clip (4) from tube assembly (1).
- (3) Remove special hex head bolts (7), special flat washers (8) and hose assembly (6).
- (4) Remove capscrows (3) and bracket (9).
- (5) Remove hex nuts (10) and flat washer (11), loosen connector and remove hose assembly (6).



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- | | | |
|--------------------------|-------------------|-------------------|
| 1. Tube Assembly | 9. Bracket | 17. Hose Assembly |
| 2. Closed Clip | 10. Hex Nut | 18. Tube Assembly |
| 3. Capscrew | 11. Flat Washer | 19. Closed Clip |
| 4. Holddown Clip | 12. Tube Assembly | 20. Capscrew |
| 5. Tube Assembly | 13. Strap Clip | 21. Closed Clip |
| 6. Hose Assembly | 14. Tube Assembly | 22. Capscrew |
| 7. Special Hex Head Bolt | 15. Tube Assembly | 23. Tube Assembly |
| 8. Special Flat Washer | 16. Retaining Cup | 24. Capscrew |

Figure 5-139. Brake Lines Group

- (6) Remove capscrews (3) and bracket (9).
 - (7) Loosen connector and remove tube assembly (5).
 - (8) Remove capscrew (3) and strap clip (13) and remove tube assemblies (12) and (14).
 - (9) Remove capscrews (3) and holddown clips (4); remove retaining clip (16), loosen connectors and remove tube assembly (15).
 - (10) Remove hose assembly (17).
 - (11) Loosen connectors, remove capscrew (20) and (22) and remove tube assembly (18).
 - (12) Remove closed clips (19) and (21) from tube assembly (18).
 - (13) Loosen connectors and remove capscrew (24); remove tube assembly (23) and T-fitting.
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following step:
- (1) Inspect brake lines for swelling, distortion, kinks or cracks. Any brake line exhibiting these conditions must be replaced.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install brake lines group as follows:

- (1) Install tube assembly (23) and T-fitting; tighten connectors and install capscrew (24).
- (2) Install closed clips (19) and (21) on tube assembly (18).
- (3) Install tube assembly (18), tighten connectors and install capscrews (20) and (22).
- (4) Install hose assembly (17) and tighten connector connecting assembly (17) to T-fitting.
- (5) Connect tube assembly (15) to hose assembly (17), tighten connector and install retaining clip (16). Tighten opposite connector and install holddown clips (4) and capscrews.
- (6) Install bracket (9) using capscrews (3).
- (7) Install tube assemblies (12) and (14) using strap clip (13) and capscrew (3). Tighten connectors.
- (8) Install tube assembly (5) and tighten connector.
- (9) Install hose assembly (6) and tighten connector to brake.
- (10) Connect free connectors of hose assembly (6) and tube assembly (5) at bracket (9) using flat washers (11) and hex nuts (10).
- (11) Install closed clips (2) on tube assembly (1).
- (12) Install tube assembly (1), connect connector and holddown clips (4) and capscrews (3); fasten closed clips (2) to vehicle using capscrews (2).
- (13) Install bracket (9) using capscrews (3).
- (14) Connect hose assembly (6) using special flat washers (8) and special hex head bolt (7).
- (15) Connect free connectors of tube assembly (1) and hose assembly at bracket (9) using flat washer (11) and hex nut (10).
- (16) Refer to paragraph 4-4.5 and refill master cylinder and bleed brake lines.

5-5.7.6 Front Brake Caliper Group. Refer to figure 5-140, and perform the following steps to overhaul the front brake caliper group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove front brake caliper group as follows:

- (1) Remove two-thirds of brake fluid from master cylinder front reservoir.
- (2) Raise vehicle.
- (3) Remove wheel and tire.
- (4) Bottom piston (4) using pry bar or large C-clamp.
- (5) Remove bolt package (6) and components of hardware kit (8).
- (6) Remove brake lines. Tape off ends to prevent spillage of brake fluid.
- (7) Remove caliper assemblies (1) and (2) by lifting them upward and out of shield and support. Place caliper assemblies (1) and (2) on front spring or other suitable support.

NOTE

Do not allow brake hose to support weight of caliper assemblies.

- (8) Remove hardware kit (8), shoe spring package (9) and shoe set (7).
- (9) Clean caliper exterior with brake fluid (27, table 5-1).
- (10) Drain remaining fluid from caliper assemblies (1) and (2) and place caliper assemblies (1) and (2) on clean work surface.
- (11) Pad caliper interiors with clean shop cloths.
- (12) Insert air nozzle into caliper fluid inlet holes and slowly apply just enough air pressure to ease piston packages (4) out of bore.

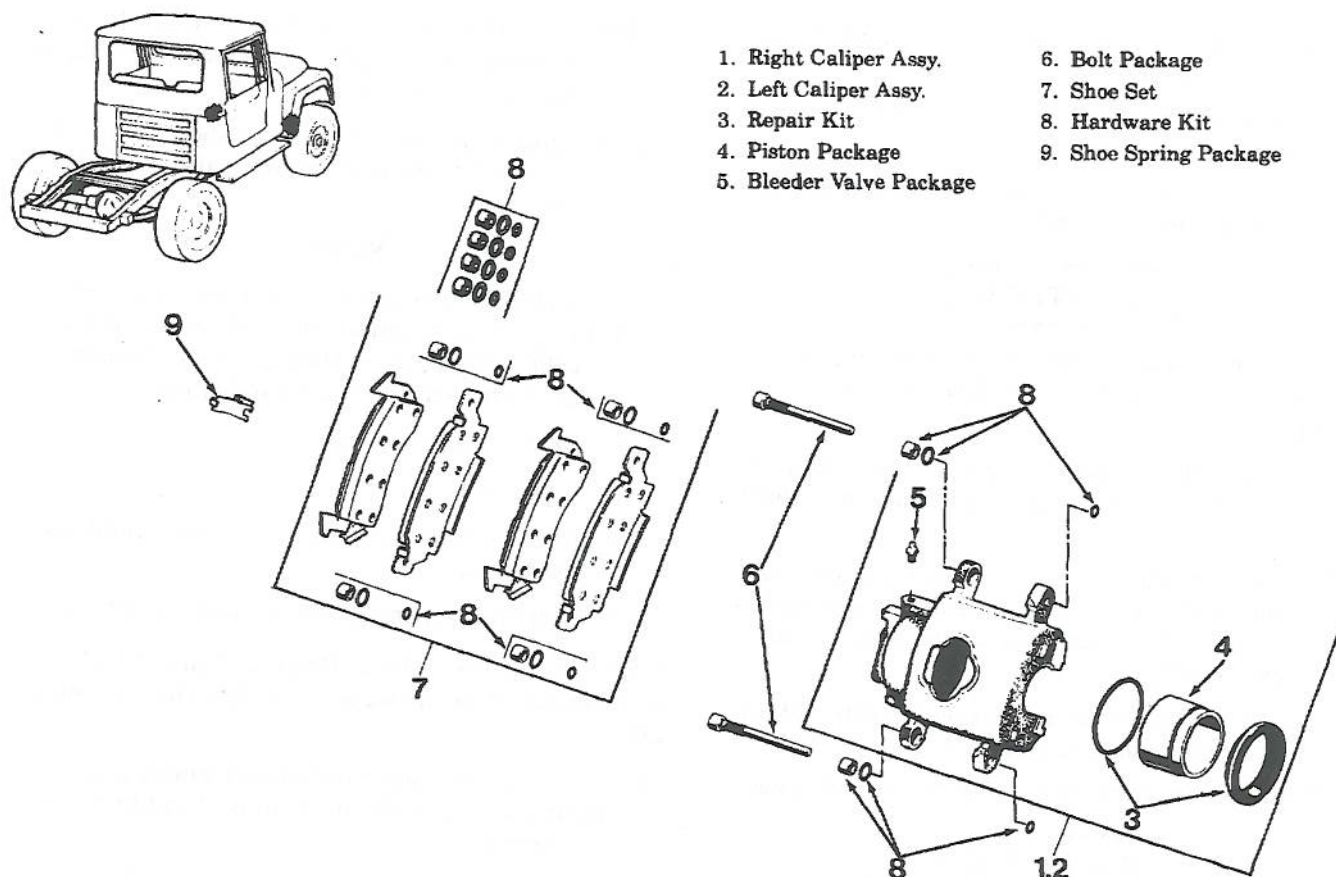
WARNING

Do not place fingers in front of the piston in an attempt to catch or protect it. Use only enough air pressure to ease the piston out of the bore. Excessive air pressure can eject the piston with enough force to cause damage or injury.

CAUTION

Remove repair kit seals using a wooden or plastic tool as a metal tool could score the piston bore.

- (13) Remove and discard repair kit (3) seals.
 - (14) Remove bleeder valve packages (5).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition perform the following steps:
- (1) Clean all parts in clean brake fluid (27, table 5-1).



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Figure 5-140. Front Brake Caliper Group

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure must remain under 30 psi and goggles must be worn.

- (2) Replace mounting bolts if threads are corroded or damaged.

CAUTION

Do not attempt to clean or polish mounting bolts with abrasives as the protective plating will be removed.

- (3) Inspect piston for nicks, scratches or corrosion. If any of these conditions are present, piston must be replaced.
- (4) Inspect piston bore for nicks, scratches or corrosion. If any of the conditions are present, caliper must be replaced. Minor cor-

rosion and stains may be removed using a crocus cloth.

- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install front brake caliper group as follows:

- (1) Lubricate piston bores and repair kit (3) seals with brake fluid (27, table 5-1).
- (2) Install repair kit (3) seals in bore groove. Work seals into grooves using fingers only.
- (3) Lubricate piston packages (4) with brake fluid.
- (4) Install replacement dust boots on pistons. Slide metal retainer portions of boots over open end of pistons and pull boot rearward until rubber boot lips seat in piston grooves.
- (5) Push metal retainer portions of boots forward until retainers are flush with rings at open end of piston and boot folds snap into place.

- (6) Insert pistons into bores and into piston seals. Do not unseat seals.
- (7) Press piston to bottom of bore using hammer handle.
- (8) Set metal retainer portions of dust boots in counterbores using tool #J-22904.

CAUTION

The metal portions of the dust boots must be seated evenly and below the faces of the calipers.

- (9) Install bleeder screw. Tighten screw securely, but not to required torque until brakes have been bled.
- (10) Install replacement copper gaskets on brake lines and connect lines to calipers assemblies (1) and (2). Tighten brake line bolts to torque specified by table 6-2.
- (11) Lubricate hardware kit (8) components with silicone lubricant (28, table 5-1).
- (12) Install rubber bushings in caliper mounting ears.

CAUTION

Do not use the original old bushings on sleeves. Use replacement parts only.

- (13) Install sleeves in inboard mounting ears of caliper. Position sleeves with sleeve ends facing shoes and linings flush with machined surfaces of mounting ears.
- (14) Install shoe spring packages (9) on inboard shoes of shoe set (7). Place single tang ends of springs over notches in shoes.
- (15) Install inboard shoes in caliper assemblies (1) and (2). Be sure shoes are flush against pistons and that springs (9) are fully seated in pistons.
- (16) Install outboard shoes of shoe set (7). Shoe ears should rest on upper surfaces of caliper mounting ears and lower shoe tabs should fit into cut-out in caliper assemblies (1) and (2). Be sure shoes are fully seated.
- (17) Position caliper assemblies (1) and (2) over rotors and in support shields and brackets.
- (18) Install bolt package (6) bolts. Be sure bolts pass under inboard shoe retaining ears and insert bolts until they enter bores in outboard shoe and caliper mounting ears. Thread bolts into support brackets and tighten to torque specified by table 6-2.

- (19) Fill master cylinder with brake fluid. Refer to paragraph 4-4.5 and bleed brake lines. Pump brake pedal to seat shoes.
- (20) Clinch upper ears of outboard shoes until radial clearance between shoes and calipers is eliminated.

NOTE

Outboard shoes with formed ears are designed for original installation only and are fitted to the caliper. These shoes should never be relined or reconditioned for future installation.

- (21) Install wheel and tire.
- (22) Lower vehicle.
- (23) Check and correct master cylinder fluid level as necessary.
- (24) Test brake operation before moving vehicle.

5-5.7.7 Front Brake Disc. Refer to figure 5-141, and perform the following steps to overhaul the front brake disc.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove front brake disc as follows:
 - (1) Remove two-thirds of brake fluid from master cylinder front reservoir.
 - (2) Raise vehicle.
 - (3) Remove wheels and tires. Refer to paragraph 5-5.7.6 and remove calipers.
 - (4) Remove grease caps (1).
 - (5) Remove bearing lockrings (2), using tool #J-6893, and lockwashers (3).
 - (6) Remove locknut and pin assembly (4), using tool #J-6893.
 - (7) Remove cone and rollers (5).
 - (8) Remove outer bearing caps (11).
 - (9) Remove hub and disc assemblies (8).
 - (10) Remove wheel bolts (9) from hub and disc assemblies (8).
 - (11) Remove inner bearing caps (10).
 - (12) Remove bearing assemblies (7).
 - (13) Remove hub seals (6).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:

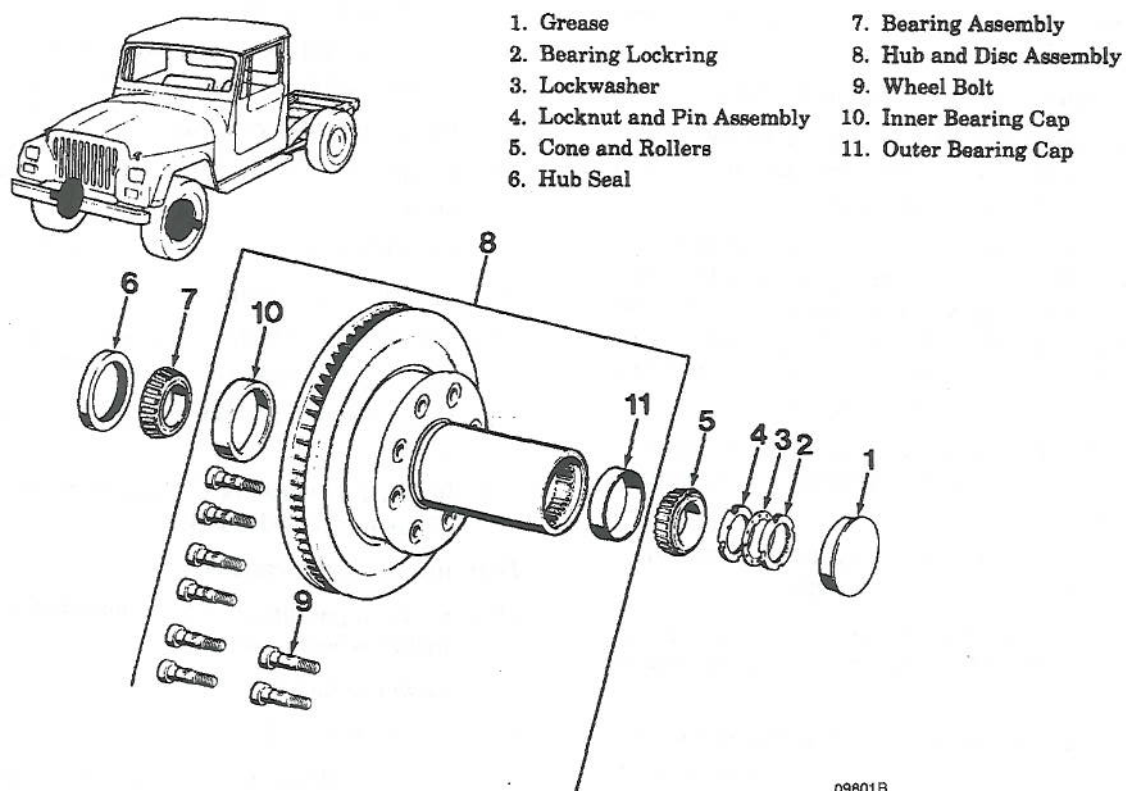


Figure 5-141. Front Brake Disc

- (1) Clean all parts in clean brake fluid (27, table 5-1) only.
- (2) Inspect wheel bolts for corrosion or thread damage. If corroded or damaged, wheel bolts must be replaced.

CAUTION

Do not attempt to clean or polish wheel bolts with abrasives as the protective plating may be removed.

- (3) Inspect disc for rust or scoring. If rust or scoring is present, disc must be cleaned with flat sanding discs while turning on lathe.
- (4) Check rotor thickness at center of lining contact area. If thickness is below figure prescribed by table 6-1 rotor must be replaced.
- (5) Measure disc lateral runout (figure 5-142) as follows in steps (6) through (8):
- (6) Mount dial indicator stylus on support stand or steering spindle.
- (7) Position indicator stylus so it contacts center of disc lining contact area and zero indicator.

- (8) Turn disc 360 degrees and note indicator reading. If runout exceeds figure stated in table 6-1, disc must be refinished. If runout exceeds replacement limit as stated in table 6-1, disc must be replaced.

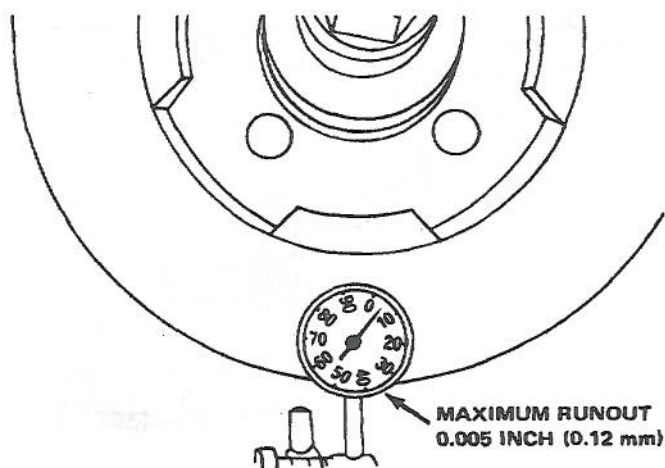


Figure 5-142. Checking Lateral Runout

- (9) Measure thickness variation of the disc (figure 5-143) as follows:
 - (10) Use micrometer or two dial indicators.
 - (11) Take readings at four or more equally spaced points around disc circumference and 1 inch inward from outer edge of disc.
 - (12) Thickness variation must not vary from point-to-point by more than the figure stated in table 6-1. If thickness variation exceeds limit, disc must be refinished. If refinishing would cause disc thickness to fall below figure prescribed by table 6-1, disc must be replaced.
- c. Repair and replacement. Replace all worn or damaged parts. In addition, perform the following steps:
- (1) Clean rust or scoring off disc using flat sanding discs while turning disc on lathe.
 - (2) If disc has lateral runout not exceeding figure prescribed by table 6-1, refinish disc on lathe.
 - (3) If disc has thickness variation exceeding figure prescribed by table 6-1, refinish disc on lathe.
- d. Assembly and installation. Assembly is accomplished during installation. Install front brake disc as follows:

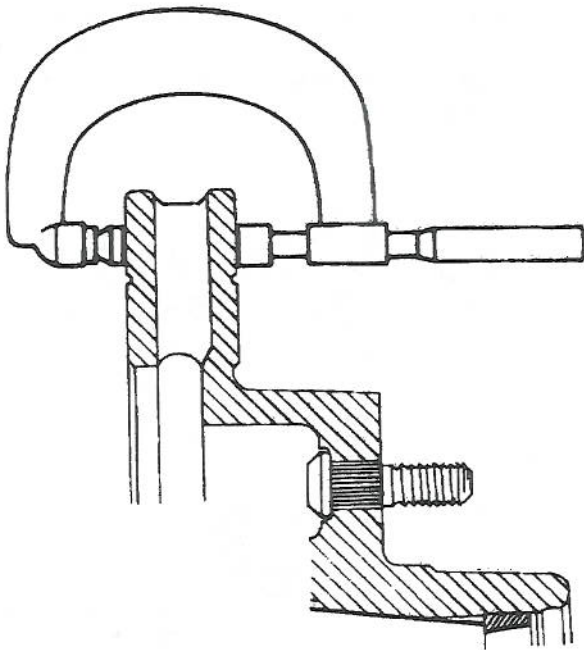
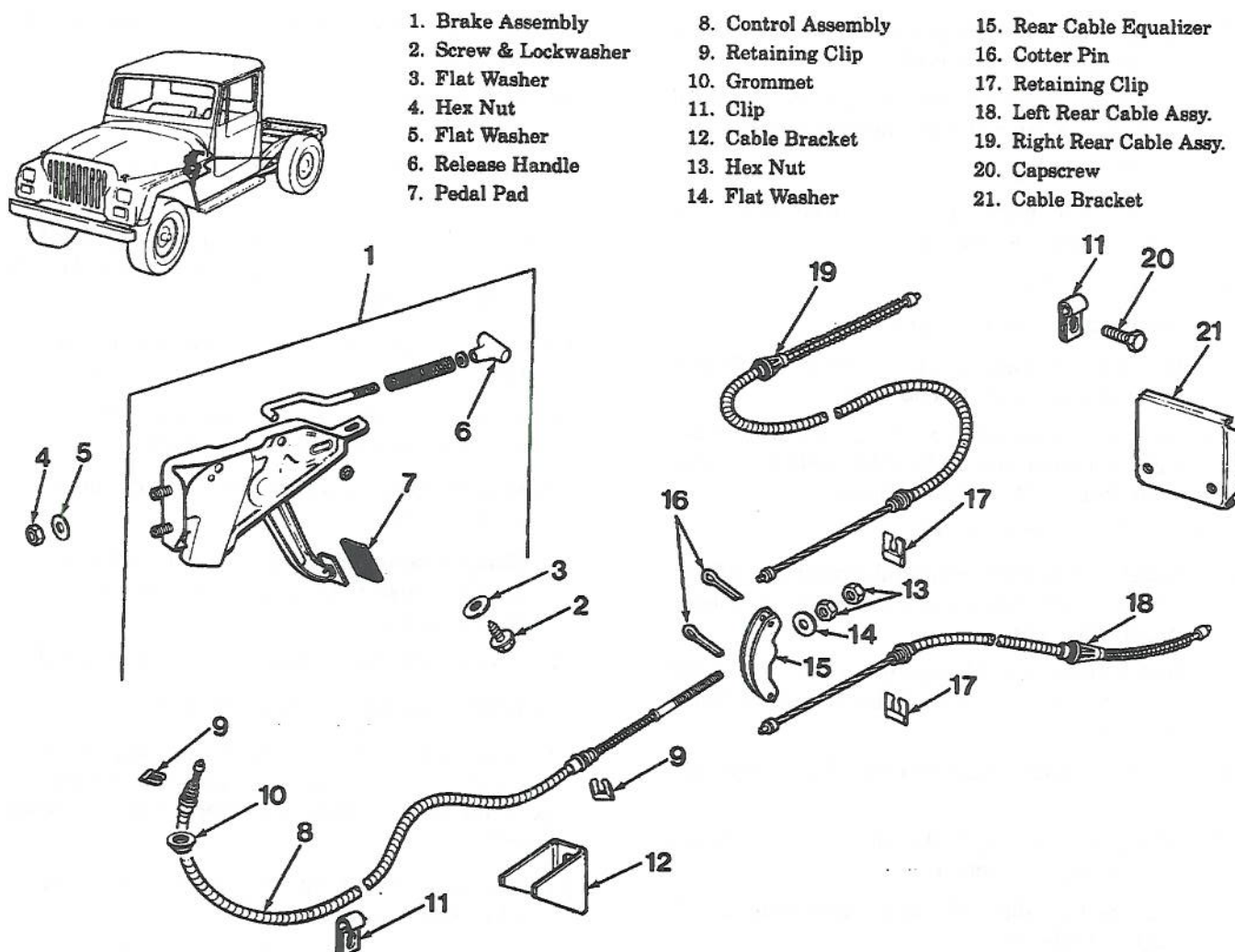


Figure 5-143. Checking Disc Thickness Variation

- (1) Install hub seals (6).
- (2) Lubricate and install bearing assemblies (7) with wheel bearing grease (29, table 5-1).
- (3) Install inner bearing caps (10).
- (4) Install wheel bolts (9) in hub and disc assemblies (8).
- (5) Install hub and disc assemblies (8).
- (6) Install outer bearing caps (11).
- (7) Lubricate and install cone and rollers (5) with wheel bearing grease (29, table 5-1).
- (8) Install locknut and pin assemblies (4) using tool #J-6893.
- (9) Install lockwashers (3) and bearing lockrings (2) using tool #J-6893.
- (10) Install grease caps (1).
- (11) Refer to paragraph 5-5.7.6 and install calipers. Install wheels and tires.
- (12) Lower vehicle.
- (13) Add brake fluid.

5-5.7.8 *Parking Brake Group*. Refer to figure 5-144, and perform the following steps to overhaul the parking brake group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove parking brake group as follows:
- (1) Raise vehicle.
 - (2) Remove hex nuts (13) and flat washer (14).
 - (3) Remove front control assembly (8) from rear cable equalizer (15).
 - (4) Remove cotter pins (16) and rear cable equalizer (15).
 - (5) Remove rear cable assemblies, left (18) and right (19), from retaining clips (17) and remove retaining clips (17).
 - (6) Refer to paragraph 5-5.7.9 and disassemble rear drum brakes as far as necessary to remove left and right rear cable assemblies (18) and (19).
 - (7) Remove cable bracket (21).
 - (8) Remove capscrews (20) and clip (11).
 - (9) Remove front control assembly (8) from retaining clips (9) and remove retaining clip (9).
 - (10) Remove front control and assembly (8) from cable bracket (12).
 - (11) Remove clip (11).



09899B

Figure 5-144. Parking Brake Group

- (12) Remove retainer clip (9).
 - (13) Disengage front control assembly (8) from parking brake lever.
 - (14) Remove front control assembly (8) and remove grommet (10).
 - (15) Remove screw and lockwasher (2) and flat washer (3).
 - (16) Remove release handle (6).
 - (17) Remove hex nuts (4), flat washers (5) and brake assembly (1).
 - (18) Remove pedal pad (7).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install parking brake group as follows:
- (1) Install pedal pad (7).
 - (2) Install brake assembly (1) using hex nuts (4) and washers (5).
 - (3) Install release handle.
 - (4) Install screw and lockwasher (2) and flat washer (3).
 - (5) Install front control assembly (8) through floorpan and install grommet (10) on cable and in floorpan.

- (6) Install bolts connecting front conduit and cable assembly to brake assembly (1).
- (7) Install pin through handle (6) and front control assembly (8) and install retainer clip (9).
- (8) Install clip (11).
- (9) Install cable bracket (12) and install front control assembly (8) through it.
- (10) Install retainer clip (9).
- (11) Install capscrews (20) and clip (11).
- (12) Install cable bracket (21) on left and right rear cable assemblies (18) and (19).
- (13) Refer to paragraph 5-5.7.9 and install left and right rear cable assemblies (18) and (19) on rear drum brakes. Reassemble brakes.
- (14) Install retainer clips (17).
- (15) Install left and right rear brake cable assemblies (18) and (19) in rear cable equalizer (15) using cotter pins (16).
- (16) Install front control assembly (8) in rear cable equalizer (15) and install flat washer (14) and hex nuts (13).
- (17) Adjust parking brake by performing steps (18) through (22).
- (18) Make sure parking brakes are released and hex nuts (13) are loosened.
- (19) Tighten hex nuts (13) until slight drag is produced at wheels.
- (20) Loosen hex nuts (13) until wheels rotate freely and brake drag is eliminated.
- (21) Tighten hex nuts (13) securely.
- (22) Check parking brake operation.

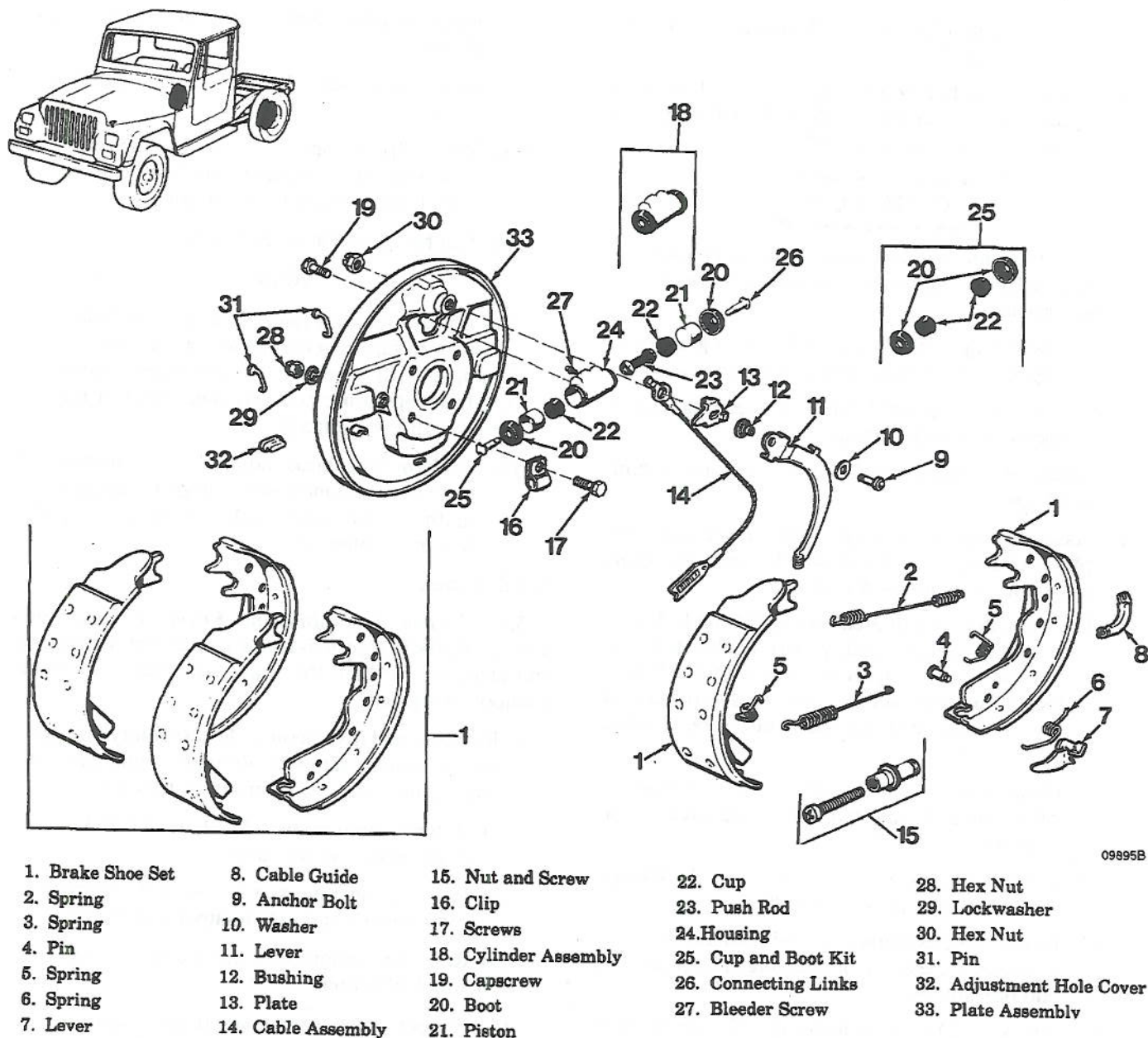
5-5.7.9 *Rear Brake and Cylinder Group*. Refer to figure 5-145, and perform the following steps to overhaul the rear brake and cylinder group.

NOTE

Left and right rear brakes and cylinders are identical and are removed and disassembled in a similar manner.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove rear brake and cylinder group as follows:
 - (1) Loosen hex nuts at parking brake equalizer to relieve cable tension.
 - (2) Refer to paragraph 5-5.7.2 and remove rear wheels.

- (3) Refer to paragraph 5-5.6.5 and remove rear brake drums.
 - (4) Remove springs (2), spring (3), springs (5) and pins (31).
 - (5) Remove pin (4), spring (6), lever (7) and cable guide (8).
 - (6) Remove hex nut (30), anchor bolt (9), washer (10), lever (11), bushing (12), plate (13) and cable assembly (14).
 - (7) Remove brake shoe set (1) and nut and screw (15).
 - (8) Remove hex nuts (28), lockwashers (29), screws (17) and clip (16) from plate assembly (33).
 - (9) Remove two capscrews (19) and cylinder assembly (18).
 - (10) Remove two connecting links (26), cup and boot kit (25), push rod (23) and bleeder screw (27) from housing (24).
 - (11) Disassemble boot (20), cup (22), and piston (21).
 - (12) Remove adjustment hole cover (32).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:
 - (1) Inspect brake lining for wear and compare to limit specified in table 6-1.
 - (2) Inspect lining for wear. Lining must be replaced if wear is uneven across width of lining. Check drum for distortion and runout if wear is uneven.
 - (3) Inspect lining for cracks, charred surface or broken rivets. Lining must be replaced if these conditions exist or if it is contaminated with brake fluid, axle lubricant or similar contaminants.
 - (4) Inspect all springs for breaking, distortion, discoloration (overheated) or lack of tension.
 - (5) Inspect levers (7) and (11) for wear and defects such as bending or breaking.
 - (6) Inspect adjusting nut and screw (15) for excessive wear. The screw must rotate freely.
 - (7) Inspect cables for wearing, fraying, kinking or seizure. Check for missing or loose cable end retainer buttons.
 - (8) Inspect parking brake lever (11) for distortion and worn pivot pin for proper cable retention.



09895B

Figure 5-145. Rear Brake and Cylinder Group

- (9) Inspect wheel cylinders for evidence of leakage. Pull back dust boots (20) and check for leakage past cups (22).
- (10) Inspect bleeder screw (27) and hydraulic line connection for evidence of leakage or damaged threads.
- (11) Check brake lines for swelling, distortion, kinks or cracks.

WARNING

Remove brake lining residue with a cloth dampened with P-D-680 Type II solvent. Do not use compressed air. Consult local bioengineer for evaluation/review of this operation.

P-D-680 Type II is toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Good general ventilation is normally adequate.

- (12) Clean plate (33) with cloth dampened with P-D-680 Type II.
- (13) Inspect anchor bolt (9) for wear or looseness and polish with crocus cloth. Polish ledges of plate (33) with emery cloth.



Do not attempt to reduce deep ridges or grooves by grinding or improper shoe-to-drum contact may result.

- (14) Check ledges of plate (33) for deep grooves or ridges which might restrict movement of shoe (1).
- (15) Refer to paragraph 5-5.6.5 for cleaning and inspection of brake drums.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Installation is accomplished during assembly. Install the rear brake drum and cylinder group as follows:

- (1) Apply thin film of grease (item 25, table 5-1) to ledges of plate assembly (33), anchor bolt (9), nut and screw (15), surface where lever (7) contacts brake shoe set (1), pin (4), and portion of lever (11) that contacts secondary shoe of brake shoe set (1).
- (2) Install lever (7) cable assembly (14), spring (6), cable guide (8) and pin (4) on secondary shoe of brake shoe set (1).
- (3) Install brake shoe set (1) with lever (7), springs (5) and (6) and pins (4) and (31).
- (4) Install cable assembly (14) with anchor bolt (9), washer (10), lever (11), brushing (12), plate (13) and hex nut (30).
- (5) Use kit (25) to assemble cup (22), piston (21) and boot (20).
- (6) Assemble cylinder assembly (18) with push rod (23), two cups (22), piston (21) and boots (23); install in housing (24).
- (7) Install bleeder screw in housing (24).
- (8) Install cylinder assembly (18) with capscrews (19).
- (9) Install springs (2) and (3) and nut and screw (15).
- (10) Install clip (16), screws (17), lockwasher (29) and hex nuts (28).
- (11) Install adjustment hole cover (32).
- (12) Refer to paragraph 4-4.5 and perform initial brake adjustment.

- (13) Refer to paragraph 5-5.6.5 and install brake drums.
- (14) Refer to paragraph 5-5.7.2 and install rear wheels.
- (15) Refer to paragraph 5-5.7.8 and tighten hex nuts at parking brake equalizer to restore cable tension; lower vehicle to the ground.
- (16) Test brake operation before moving vehicle.

NOTE

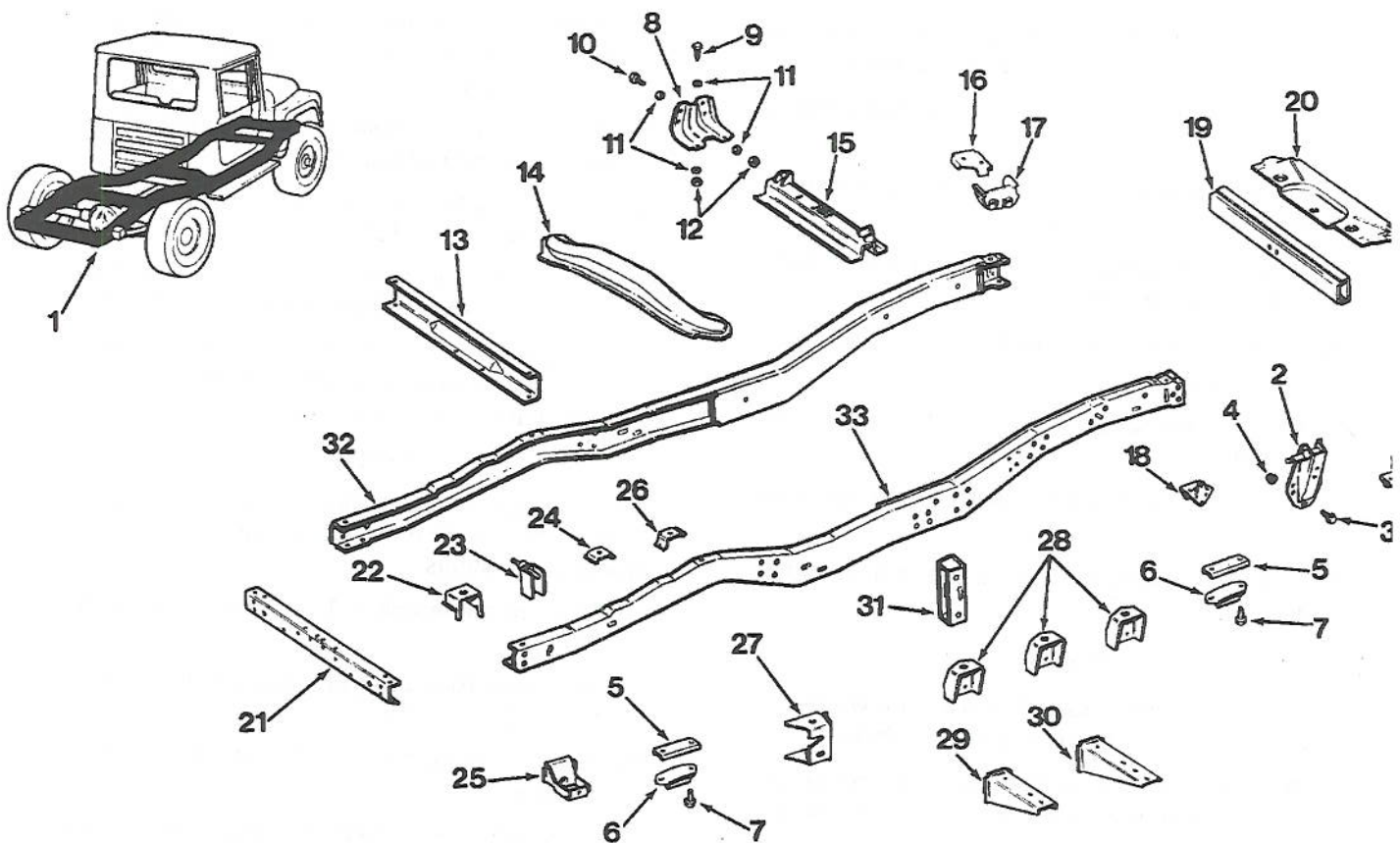
Do not use forward range of automatic transmission to halt reverse movement of vehicle. Doing so will prevent automatic brake adjusters from operating properly and result in unsatisfactory pedal height.

- (17) Perform final brake adjustment by making 10 to 15 forward and reverse stops to equalize adjustment and until satisfactory brake pedal height is obtained.

5-5.8 Frame.

5-5.8.1 *Frame Assembly and Frame Components Group.* Refer to figure 5-146, and perform the following steps to overhaul the frame assembly and frame components group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove frame assembly and frame components group as follows:
 - (1) Refer to paragraphs 5-5.5.4 and 5-5.6.3 and remove front and rear axles.
 - (2) Remove machine screws (7), axle bumper assemblies (6) and axle bumper spacers (5).
 - (3) Refer to paragraph 5-5.5.1 and remove front shock absorber.
 - (4) Support transmission and transfer case.
 - (5) Remove machine screws (3), hex nuts (4) and left front shock absorber bracket assembly (2). Remove right shock absorber bracket assembly in the same manner.
 - (6) Remove transmission support crossmember assembly (15) using cutting torch.
 - (7) Remove machine screws (9) and (10), flat washers (11) and hex nuts (12).
 - (8) Remove transmission crossmember support bracket (8).
 - (9) Refer to paragraph 5-5.4.4 and remove steering gear components.



- | | | |
|-------------------------|--------------------------|--------------------------------|
| 1. Frame Assembly | 12. Hex Nut | 23. Bracket and Shaft Assembly |
| 2. Bracket Assembly | 13. Crossmember Assembly | 24. Support Bracket |
| 3. Machine Screw | 14. Crossmember Assembly | 25. Bracket |
| 4. Hex Nut | 15. Crossmember Assembly | 26. Support Bracket |
| 5. Spacer | 16. Gusset | 27. Pivot Bracket |
| 6. Axle Bumper Assembly | 17. Bracket | 28. Bracket |
| 7. Machine Screw | 18. Bracket | 29. Mounting Bracket |
| 8. Support Bracket | 19. Crossmember Assembly | 30. Mounting Bracket |
| 9. Machine Screw | 20. Mounting Panel | 31. Reinforcement Assembly |
| 10. Machine Screw | 21. Crossmember Assembly | 32. Left Side Member |
| 11. Flat Washer | 22. Mounting Bracket | 33. Right Crossmember |

0986

Figure 5-146. Frame Assembly and Frame Components Group

- (10) Remove left steering gear mounting bracket (17) and steering gear mounting bracket gussets (16). Remove right steering gear mounting bracket in the same manner.
- (11) Refer to paragraph 5-5.6.1 and remove rear shock absorbers.
- (12) Remove rear shock absorber bracket and shaft assemblies (23) using a cutting torch.
- (13) Remove pickup box and right pickup box mounting bracket (22) using a cutting torch. Remove left pickup box mounting bracket in the same manner.
- (14) Remove rear pickup box support brackets (24) and front pickup box support brackets (26) using a cutting torch.
- (15) Refer to paragraph 5-5.6.2 and remove rear springs.

- (16) Remove rear spring brackets (25) and rear spring pivot brackets (27) using a cutting torch.
- (17) Refer to paragraph 5-5.9.1 and remove running boards.
- (18) Remove front and rear running board mounting brackets (29) and (30).
- (19) Refer to paragraph 5-5.9.2 and remove body holddown capscrews.
- (20) Remove body mount brackets (28) using a cutting torch.
- (21) Refer to paragraph 5-5.5.3 and remove front springs.
- (22) Remove front spring brackets (18) using a cutting torch.
- (23) Refer to paragraph 5-5.1.12 and remove radiator.

NOTE

Remove wiring harnesses, hoses and tie wraps as necessary for removal of crossmembers.

- (24) Remove radiator front body mounting panel (20) and front crossmember assembly (19) using a cutting torch.
 - (25) Remove intermediate crossmember assemblies (13) and (14) using a cutting torch.
 - (26) Remove frame reinforcement assemblies (31) using a cutting torch.
 - (27) Remove rear crossmember assembly (21) using a cutting torch.
 - (28) Support crossmembers (if still attached), right frame sidemember (33) and other attached assemblies; remove left frame sidemember (32) using a cutting torch. Remove right frame sidemember (33) in the same manner.
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
 - c. Repair and replacement. Replace all worn or damaged parts. In addition, after removing any part using a cutting torch, grind all residual material from remaining parts of frame assembly before welding new part in place.
 - d. Assembly and installation. Assembly is accomplished during installation. Install frame assembly and frame components group as follows:

- (1) Weld left frame sidemember (32) to crossmembers. Weld right frame sidemember (33) to frame in the same manner.
- (2) Weld new rear crossmember assembly (21) to sidemembers (32) and (33).
- (3) Weld new frame reinforcement assemblies (31) to sidemembers (32) and (33).
- (4) Weld new intermediate crossover assemblies (13) and (14) to sidemembers (32) and (33).
- (5) Weld new radiator front body mounting panel (20) and front crossmember assembly (19) to sidemembers (32) and (33).

NOTE

Replace any wiring harnesses, hoses and tie wraps which were removed during removal of frame components.

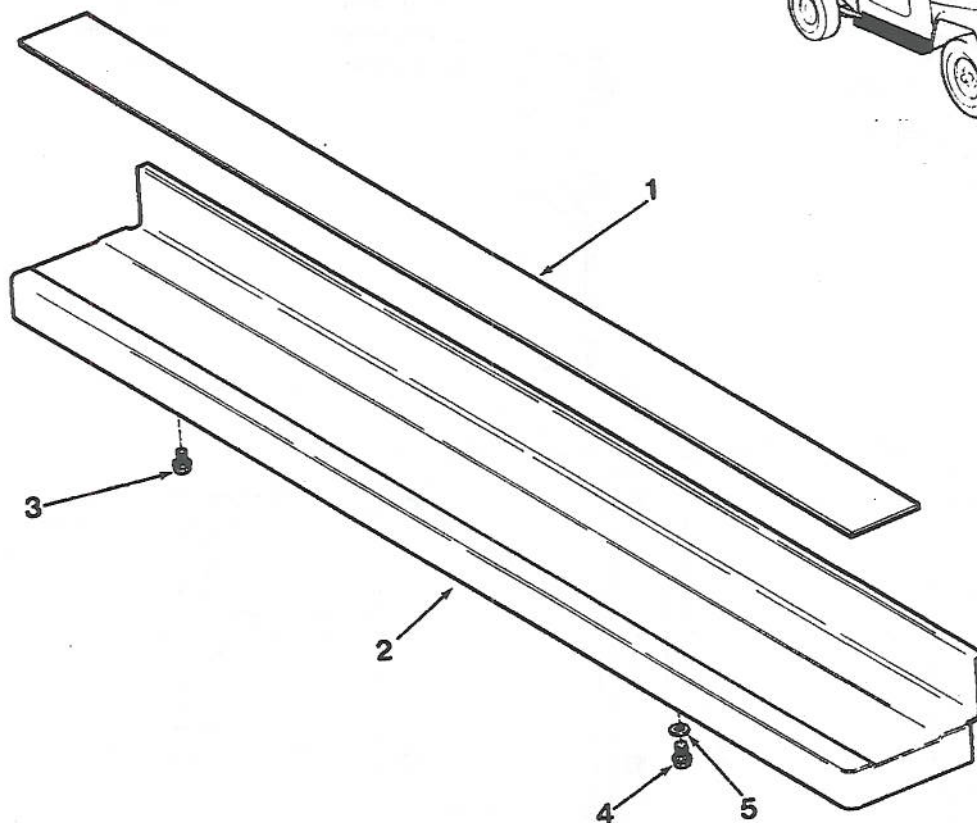
- (6) Refer to paragraph 5-5.1.12 and install radiator.
- (7) Weld new front spring brackets (18) to sidemembers (32) and (33).
- (8) Refer to paragraph 5-5.5.3 and install front springs.
- (9) Weld new body mount brackets (28) to sidemembers (32) and (33).
- (10) Refer to paragraph 5-5.9.2 and install body hold-down capscrews.
- (11) Weld new front and rear running board mounting brackets (29) and (30) to sidemembers (32) and (33).
- (12) Refer to paragraph 5-5.9.1 and install running boards.
- (13) Weld new rear spring brackets (25) and rear spring pivot brackets (27) to sidemembers (32) and (33).
- (14) Refer to paragraph 5-5.6.2 and install rear springs.
- (15) Weld new rear pickup box support brackets (24) and front pickup box support brackets (26) to sidemembers (32) and (33).
- (16) Weld new right pickup box mounting bracket (22) to sidemembers. Install left pickup box mounting bracket in the same manner.
- (17) Install pickup box.
- (18) Weld new rear shock absorber bracket and shaft assemblies (23) to sidemembers.

- (19) Refer to paragraph 5-5.6.1 and install rear shock absorbers.
- (20) Weld new steering gear mounting bracket gussets (16) to sidemembers (32) and (33).
- (21) Install new left steering gear mounting bracket (17) on gusset (16). Install right steering gear mounting bracket in a similar manner.
- (22) Refer to paragraph 5-5.4.4 and install steering gear mounting components.
- (23) Install transmission crossmember support bracket (8) on transmission support crossover assembly (15) using machine screws (9) and (10), flat washers (11) and hex nuts (12).
- (24) Weld new transmission support crossmember assembly (15) to sidemembers (32) and (33).
- (25) Remove transmission supports placed during removal.
- (26) Install left front shock absorber bracket assembly (2) using machine screws (3) and hex nuts (4). Install right shock absorber bracket assembly in the same manner.
- (27) Refer to paragraph 5-5.5.1 and install front shock absorbers.
- (28) Install axle bumper assemblies (6) and axle bumper spacers (5) using machine screws (7).
- (29) Refer to paragraphs 5-5.5.4 and 5-5.6.3 and install front and rear axles.

5-5.9 Body.

5-5.9.1 *Running Board Group*. Refer to figure 5-147, and perform the following steps to overhaul the running board group.

- | | |
|---------------------------|---------------------|
| 1. Running Board Cover | 4. Screw and Washer |
| 2. Running Board Assembly | 5. Flat Washer |
| 3. Capscrew | |



09822B

Figure 5-147. Running Board Group

a. Removal and disassembly. Disassembly is accomplished during removal. Remove running board group as follows:

- (1) Remove screws and washers (4), capscrews (3), flat washers (5) and running board assembly (2).

- (2) Remove running board cover (1).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

c. Repair and replacement. Replace all worn or defective parts.

d. Assembly and installation. Assembly is accomplished during installation. Install running board group as follows:

- (1) Install running board cover (1).

- (2) Install running board assembly (2) using screws and washers (4), capscrews (3) and flat washers (5).

5-5.9.2 *Body Holddowns Group*. Refer to figure 5-148, and perform the overhaul for the body holddowns group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove the body holddowns group as follows:

WARNING

Do not work under raised vehicle without first supporting vehicle with safety jack stands or injury to personnel may result.

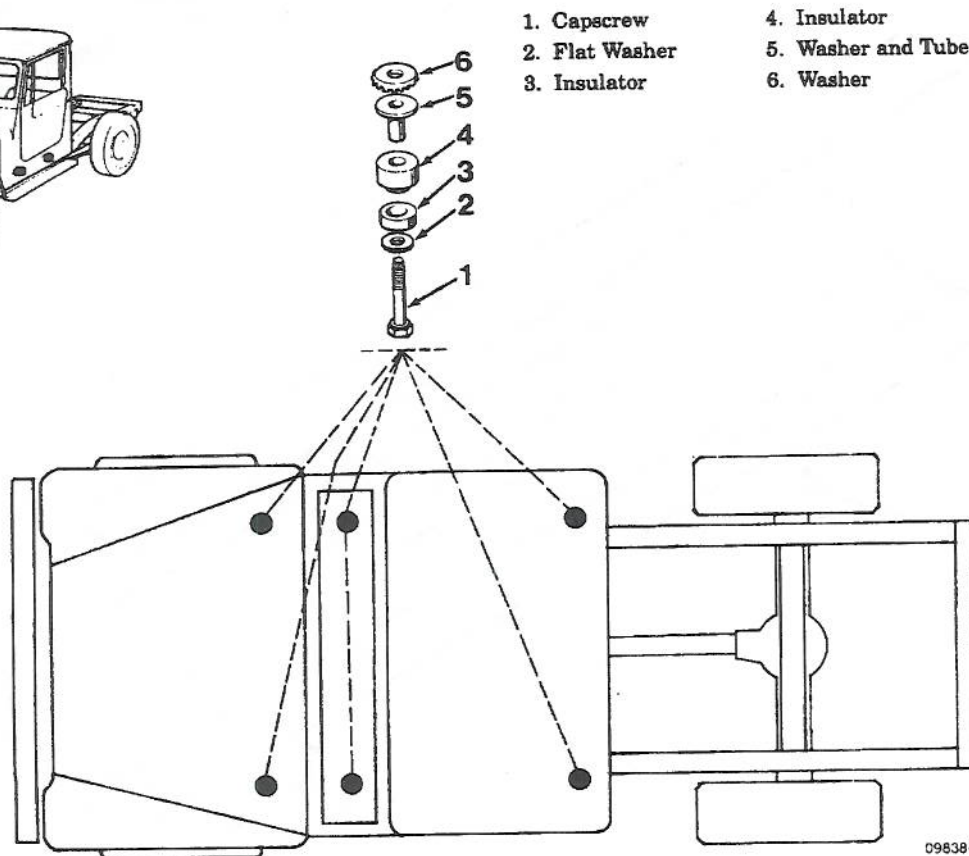
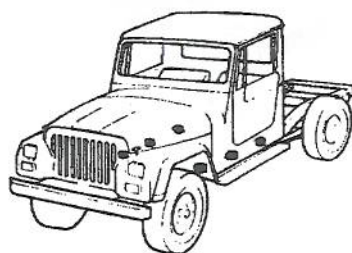
- (1) Raise vehicle and support with jack stand.

NOTE

Procedures for removing each of the six body holddown groups are identical.

- (2) Remove capscrew (1), flat washer (2) and insulator (3).

- (3) Remove insulator (4), washer and tube (5) and serrated washer (6).



09838B

Figure 5-148. Body Holddowns Group

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Remove the body hold-downs group as follows:

WARNING

Do not work under raised vehicle without first supporting vehicle with safety jack stands or injury to personnel may result.

- (1) Vehicle should be supported in raised position.

NOTE

Procedures for installing each of the six body hold-down groups are identical.

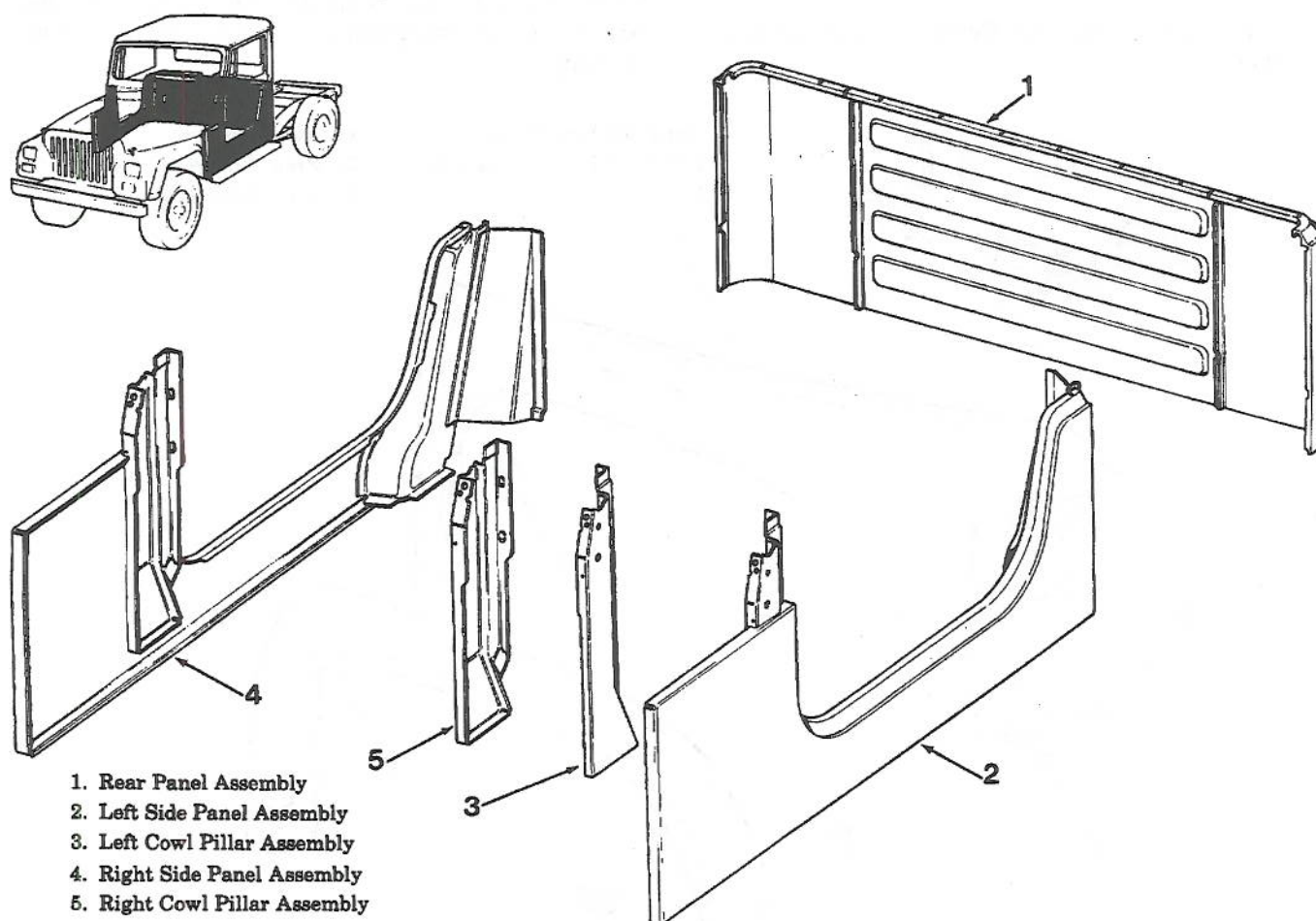
- (2) Install capscrew (1), flat washer (2) and insulator (3).
- (3) Install insulator (4), washer and tube (5) and serrated washer (6).

5-5.9.3 Body Side and Rear Panels Group. Refer to figure 5-149, and perform the following steps to overhaul the body side and rear panels group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove body side and rear panels as follows:

NOTE

Assembled sections or any of the individual panels available for replacement are complete and may be installed as a unit.



09789B

Figure 5-149. Body Side and Rear Panels Group

WARNING

Welding and brazing operations produce heat, toxic fumes, radiation, metal slag and carbon particles. Welding and brazing goggles with properly tinted lenses, gloves, apron or jacket and welder boots are required to protect the welder.

- (1) Cut and remove rear panel assembly (1).
 - (2) Cut and remove left side panel assembly (2).
 - (3) Cut and remove left cowl pillar assembly (3) from left side panel assembly (2).
 - (4) Cut and remove right side panel assembly (4).
 - (5) Cut and remove right cowl pillar assembly (5) from right side panel assembly (4).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.

- d. Assembly and installation. Assembly is accomplished during installation. Install rear and side panel assemblies as follows:

WARNING

Welding and brazing operations produce heat, toxic fumes, radiation, metal slag and carbon particles. Welding and brazing goggles with properly tinted lenses, gloves, apron or jacket and welder boots are required to protect the welder.

- (1) Weld right cowl pillar assembly (5) to right side panel assembly (4).
- (2) Weld right side panel assembly (4) in place.
- (3) Weld left cowl pillar assembly (3) into place.
- (4) Weld left side panel assembly (2) into place.
- (5) Weld rear panel assembly (1) into place.

5-5.9.4 *Front Fender Group*. Refer to figure 5-150, and perform the following steps to overhaul the front fender group.

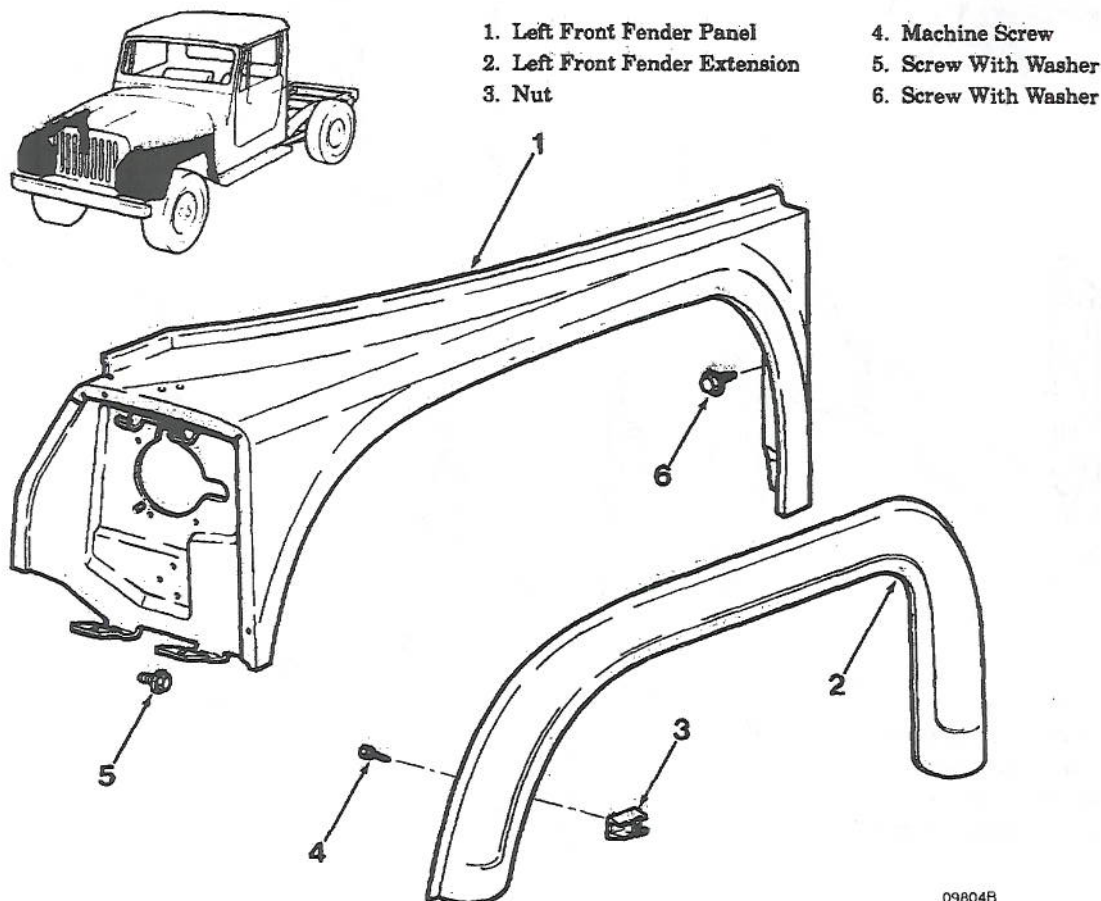
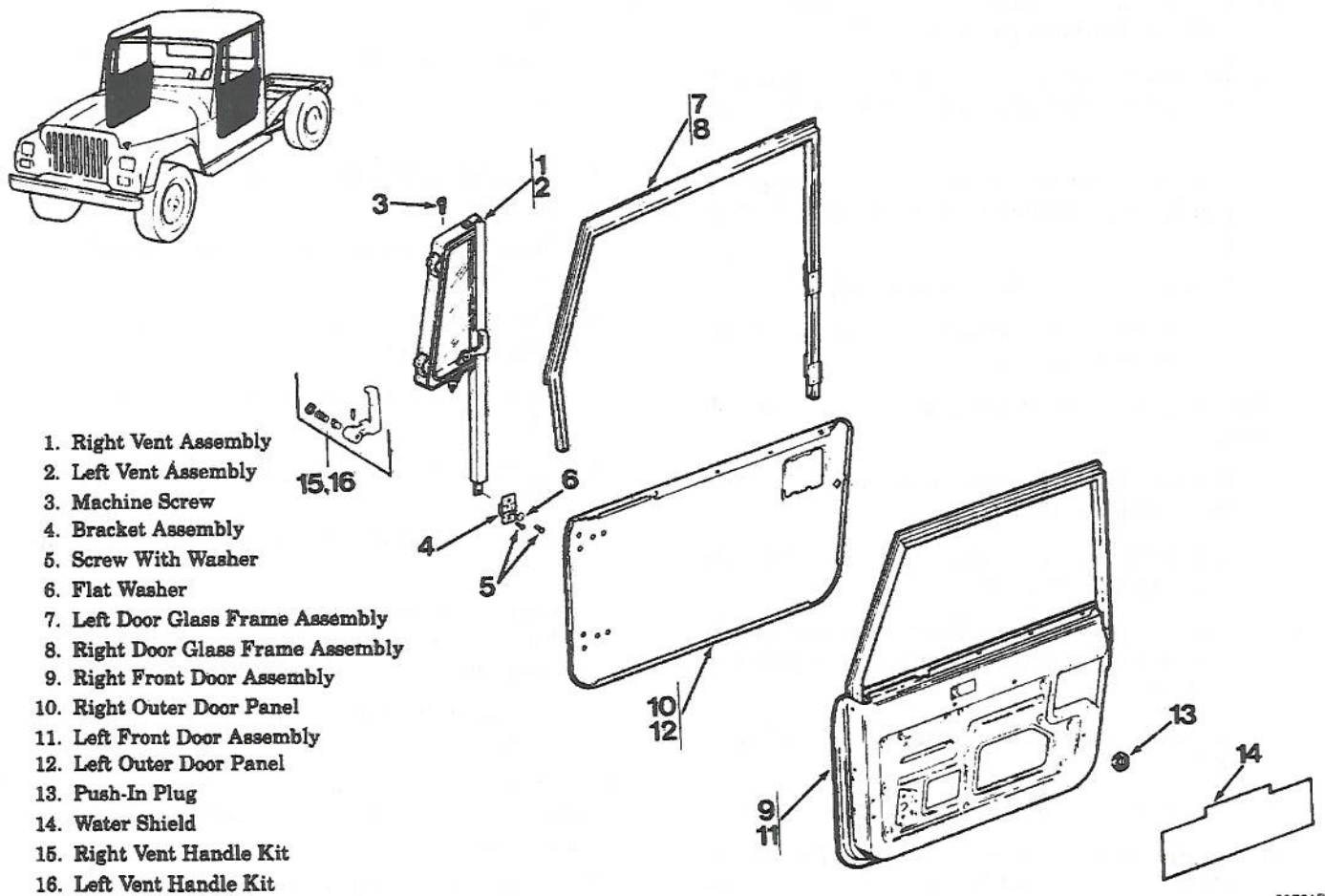


Figure 5-150. Front Fender Group

- a. Removal. Remove front fender group as follows:
 - (1) Remove or disconnect all items attached to apron of left-hand panel assembly (1).
 - (2) Remove screws and washers (5) attaching left-hand panel assembly (1) and brace to dash panel.
 - (3) Remove screw and washers (6) attaching left-hand panel assembly (1) to radiator grille panel.
 - (4) Remove left-hand panel assembly (1).
 - (5) Follow the same procedure when removing right-hand panel assembly.
 - b. Disassembly. Disassemble panel assembly as follows:
 - (1) Remove machine screws (4), nuts (3) and left front fender extension (2).
 - (2) Follow the same procedure when removing right front fender extension.
 - c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
 - d. Repair and replacement. Replace all worn or damaged parts.
 - e. Assembly. Assemble front fender group as follows:
 - (1) Position left front fender extension (2) on left-hand panel assembly (1) and align screw holes.
 - (2) Install machine screws (4) and nuts (3).
 - (3) Follow the same procedure when installing right front fender extension.
 - f. Installation. Install front fender group as follows:
 - (1) Position left-hand panel assembly (1) on vehicle and install fender-to-radiator screws and washers (6).
 - (2) Install fender-to-dash screws and washers.
 - (3) Install all items previously removed from left-hand panel assembly (1).
 - (4) Follow the same procedure when installing right-hand panel assembly.
- 5-5.9.5 *Door Group*. Refer to figure 5-151, and perform the following steps to overhaul the door group.
- a. Removal and disassembly. Disassembly is accomplished during removal. Remove door group as follows:
 - (1) Remove trim panels.
 - (2) Remove water shields (14) and push-in plugs (13).
 - (3) Remove right and left outer door panels (10) and (12).
 - (4) Remove right and left door glass assemblies (7) and (8).
 - (5) Remove screws and washers (5) and bracket assemblies (4).
 - (6) Remove machine screws (3) and flat washers (6).
 - (7) Remove right and left vent handle kits (15) and (16).
 - (8) Remove right and left door assemblies (9) and (11).
 - b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
 - c. Repair and replacement. Replace all worn or damaged parts.
 - d. Assembly and installation. Assembly is accomplished during installation. Install the door group as follows:
 - (1) Install right and left vent handle kits (15) and (16).
 - (2) Install right and left door glass assemblies (1) and (2) using machine screws (3), flat washers (6), bracket assemblies (4) and screw and washers (5).
 - (3) Install right and left door glass assemblies (7) and (8).
 - (4) Install right and left outer door panels (10) and (12).
- NOTE**
- When installing water shields, be sure the slit lower portion is tucked inside the door panels at the access openings and that the shields are bonded securely to the door inner panels.
- (5) Install push-in plugs (13) and water shields (14).
 - (6) Install trim panels.



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Figure 5-151. Door Group

5-5.9.6 *Door Hinges Group.* Refer to figure 5-152, and perform the following steps to overhaul the door hinges group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the door hinges group as follows:

NOTE

Removal procedures for left and right door hinges are identical.

- (1) Open door and remove screws (6), loop (5) and webbing strap (4).
- (2) Mark outlines of door hinges on doors and body with wax pencil.
- (3) Lift door and hinge assemblies from vehicle.

NOTE

Use torx bit tool #J-25359-C to remove all screws.

- (4) Remove screws and washers (2), pin (3) and bracket assembly (1).
- (5) Remove screws (9) and hinge assemblies (7) right, (8) left.

NOTE

Support the windshield frame during upper hinge removal.

- (6) Remove screws (17) and hinge (15) right, (16) left.
- (7) Remove shim (13); screws (12); hinges (10) right, (11) left; and plate (14).

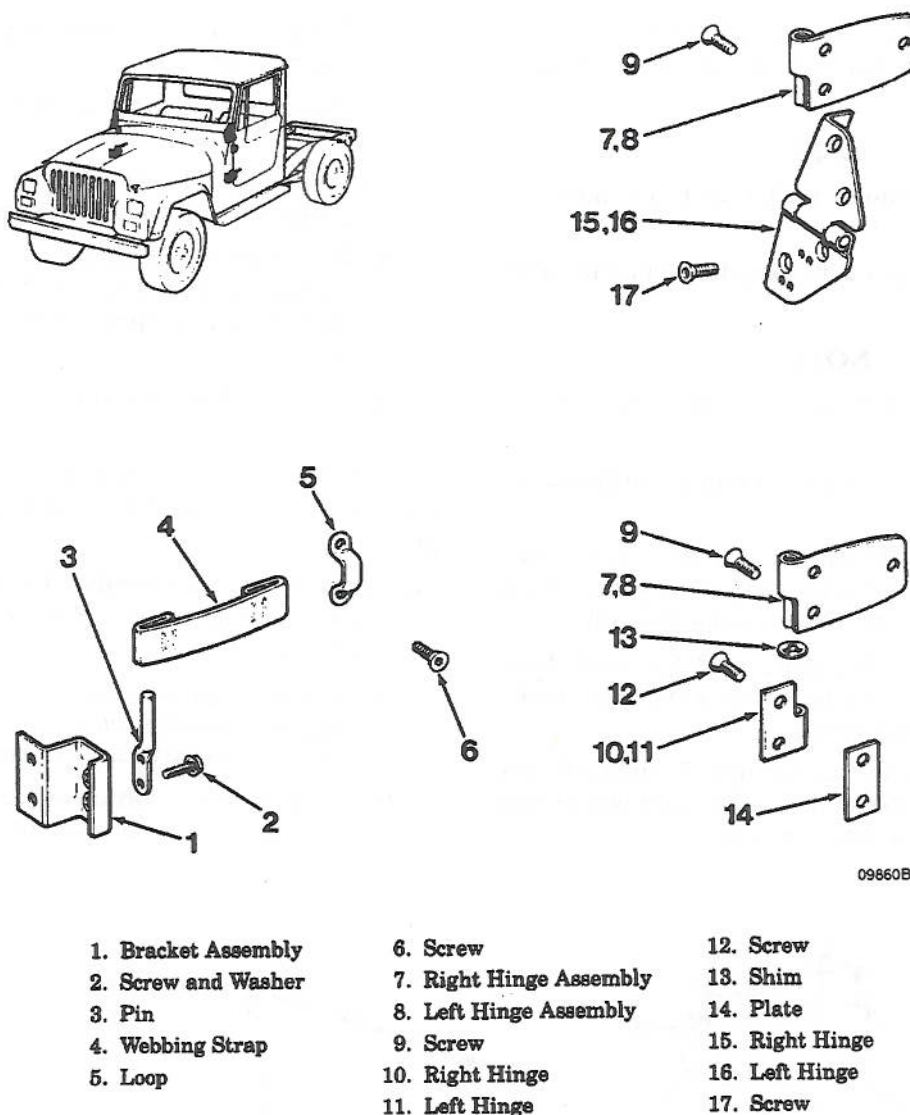


Figure 5-152. Door Hinges Group

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following steps:

- (1) Clean hinges (7) right, (8) left; hinges (10) right, (11) left; and hinges (15) right, (16) left in P-D-680 Type II solvent (7, table 5-1).

WARNING

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psi and eye protection is required.

WARNING

P-D-680 Type II is toxic to the skin, eyes and respiratory tract. Avoid skin and eye contact. Good general ventilation is normally adequate.

- (2) Blow dry all hinges with compressed air.

- c. Repair and replacement. Replace all worn or damaged parts. In addition, perform the following steps:

- (1) Refer to paragraph 5-4.4 and paint hinges (7) right, (8) left; hinges (10) right, (11) left; and hinges (15) right, (16) left with exterior spray paint (30, table 5-1).

- d. Assembly and installation. Assembly is accomplished during installation. Install the door hinges group as follows:

NOTE

Installation procedures for left and right door hinges are identical.

- (1) Lubricate hinges with spray lubricant (31, table 5-1).

NOTE

Use torx bit tool #J-25359-C to install all screws.

Support the windshield frame during upper hinge installation.

- (2) Install plate (14);, hinge (10) right, (11) left; two screws (12) and shim (13) so they align with wax pencil marks made during removal.
- (3) Install hinge (15) right, (16) left with three screws (17) so it aligns with wax pencil marks made during removal.
- (4) Install two hinge assemblies (7) right, (8) left with screws (9) so they align with wax pencil marks made during removal.

- (5) Install bracket assembly (1), pin (3) and screws and washers (2).
- (6) Hang door and hinge assemblies on pins (3) on body.
- (7) Close door and check door alignment. Door should close flush with adjacent body panels.
- (8) If door needs to be adjusted, remove door latch so door closes freely and adjust hinge positions until door is properly aligned. Reinstall door latch.
- (9) Install webbing strap (4), loop (5) and screws (6).

5-5.9.7 *Door Seals Group*. Refer to figure 5-153, and perform the following steps to overhaul the door seals group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove door seals group as follows:

- (1) Remove right seal assembly (1) from door using weatherstrip remover #J-21104-01 to remove sealer fasteners (3) panel holes.
- (2) Remove upper portion of seal assembly (1) using fingers or piece of wood.

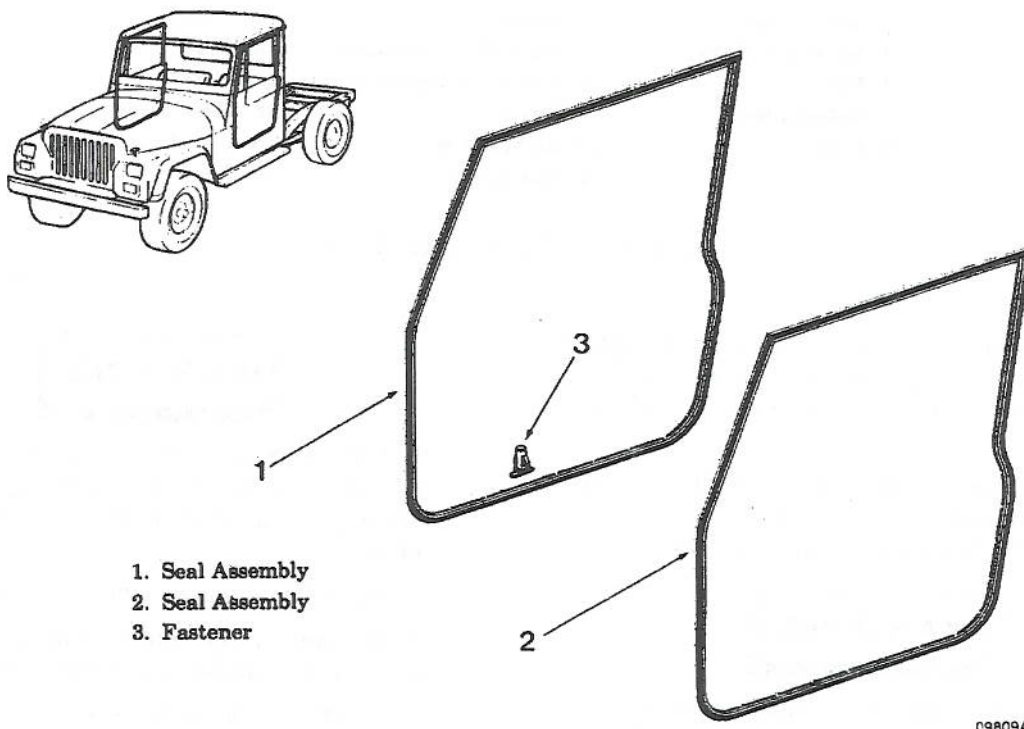


Figure 5-153. Door Seals Group

- (3) Remove dust and dirt from seal assembly (1), door and body.
- (4) Follow same procedure when removing left seal assembly (2).
- b. Cleaning inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
 - (c) Repair and replacement. Replace all worn or damaged parts.
 - (d) Assembly and installation. Assembly is accomplished during installation. Install door seals group as follows:
 - (1) Install upper front corner of right seal assembly in door frame using fingers or piece of wood to push seal assembly into door frame channel.
 - (2) Press seal fasteners (3), starting at rear edge of door, into door panel holes.
 - (3) Follow the same procedure when installing left seal assembly (2).

5-5.9.8 *Door Latch Group*. Refer to figure 5-154, and perform the following steps to overhaul the door latch group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the door latch group as follows:

NOTE

Removal procedures for left and right door latch groups are identical.

- (1) Remove door trim panel and watershield paper.
- (2) Remove screws (11) and plate (9) left, (10) right.
- (3) Remove pins (19) and rod and bushing (17) left, (18) right.
- (4) Remove clip and bushing (16) and rod (15).
- (5) Remove screws (14) and latch assembly (12) left, (13) right.
- (6) Remove screws (8) and rivets (7).
- (7) Remove striker plate assembly (2) and cover (5) left, (6) right.
- (8) Remove striker assembly (1), mounting plate (3) and shim (4).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during removal. Install the door latch group as follows:

NOTE

Installation procedures for left and right door latch groups are identical.

- (1) Install cover (5) left, (6) right using screws (8).
- (2) Install striker plate assembly (2).
- (3) Install shim (4), mounting plate (3) and striker assembly (1).
- (4) Install rivets (7).
- (5) Install latch assembly (12) left, (13) right using screws (14).
- (6) Install clip and bushing (16) and rod (15).
- (7) Install rod and bushing (17) left, (18) right and pins (19).
- (8) Install plate (9) left, (10) right using screws and washers (11).
- (9) Install watershield paper and door trim panel.

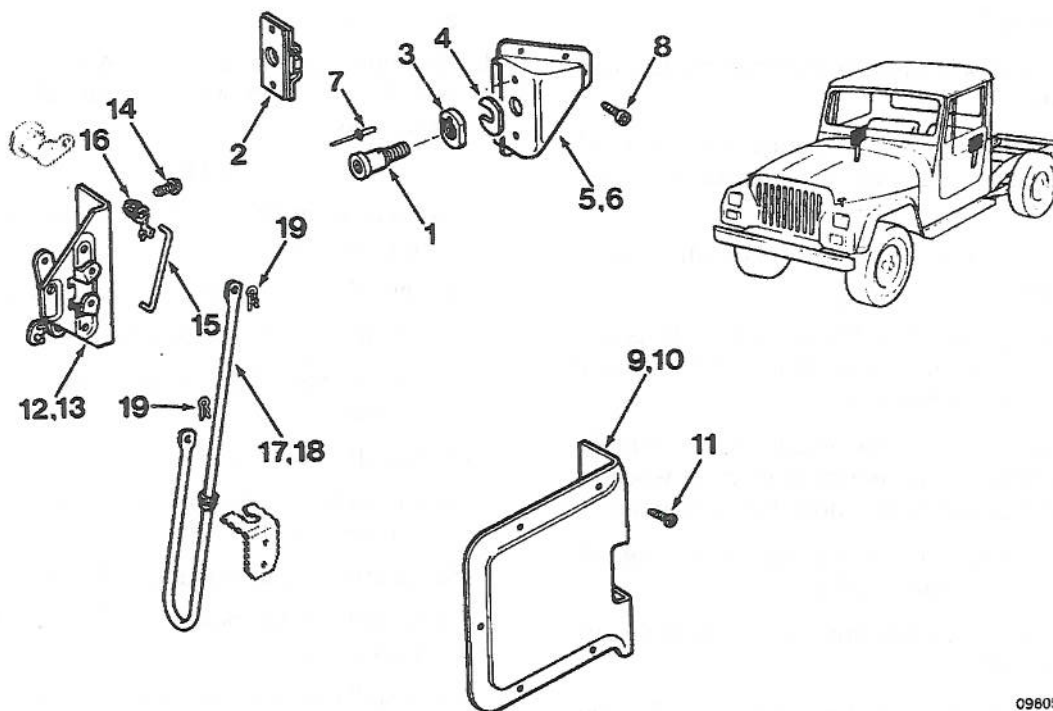
5-5.9.9 *Door Handles and Lock Rod Group*. Refer to figure 5-155, and perform the following steps to overhaul the door handles and lock rod group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove door handle and lock rod group as follows:

NOTE

Procedures for removing left and right door handles and lock rod groups are identical.

- (1) Remove screw (3) using torx bit tool #J-25359-C from interior handle assembly (1) and remove handle assembly (2).
- (2) Remove handle assembly (1) from door.
- (3) Remove door trim panel and watershield paper from door.
- (4) Remove rods (4) and (5).
- (5) Remove plugs (11).
- (6) Close window completely and tap door keepers (10) up.
- (7) Remove outside handle assembly (6) and handle assembly (7).
- (8) Remove bezel (8) and gasket (9).



09805A

1. Striker Assembly
2. Striker Plate Assembly
3. Mounting Plate
4. Shim
5. Left Cover
6. Right Cover

7. Rivet
8. Screw
9. Left Plate
10. Right Plate
11. Screws
12. Left Latch Assembly

13. Right Latch Assembly
14. Screw
15. Rod
16. Clip and Bushing
17. Left Rod and Bushing
18. Right Rod and Bushing
19. Pin

Figure 5-154. Door Latch Group

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install the door handles and lock rod group as follows:

NOTE

Procedures for installing the left and right door handles and lock rod groups are identical.

- (1) Install bezel (8) and gasket (9).
- (2) Install handle assemblies (6) and (7).
- (3) Tap door keepers (10) lightly downward to tighten handle.

- (4) Install plugs (11).
- (5) Install rod (4) and rod (5).
- (6) Install watershield paper and door trim panel.
- (7) Install handle assembly (1) and handle assembly (2) with screw (3). Tighten screws using torx bit tool #J-25359-C.

5-5.9.10 *Locks and Keys Group*. Refer to figure 5156, and perform the following steps to overhaul the locks and keys group.

- a. Removal. Remove door lock assemblies as follows:
 - (1) Remove door trim panel and watershield paper.
 - (2) Remove door latch cover screws and remove covers.

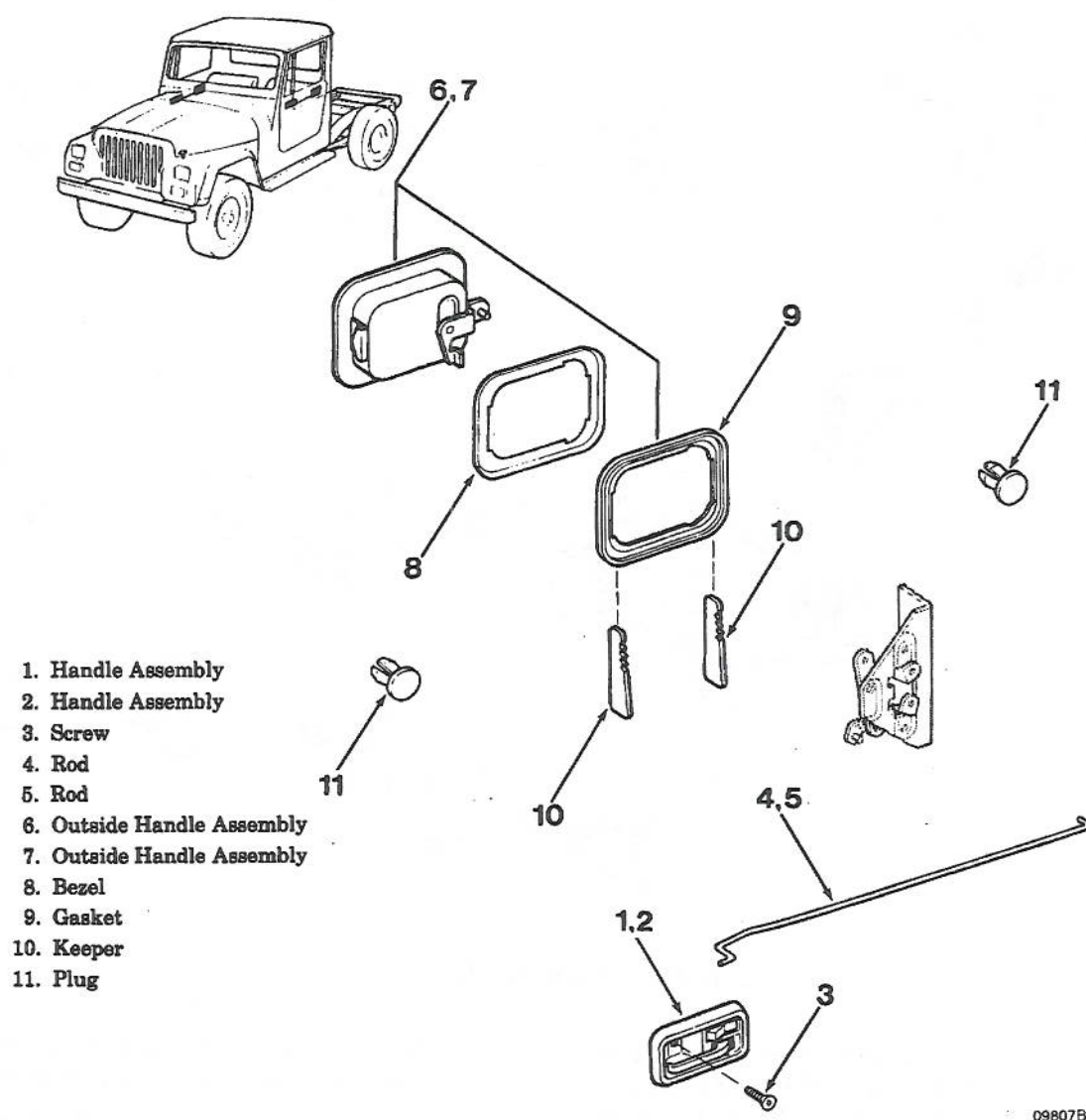
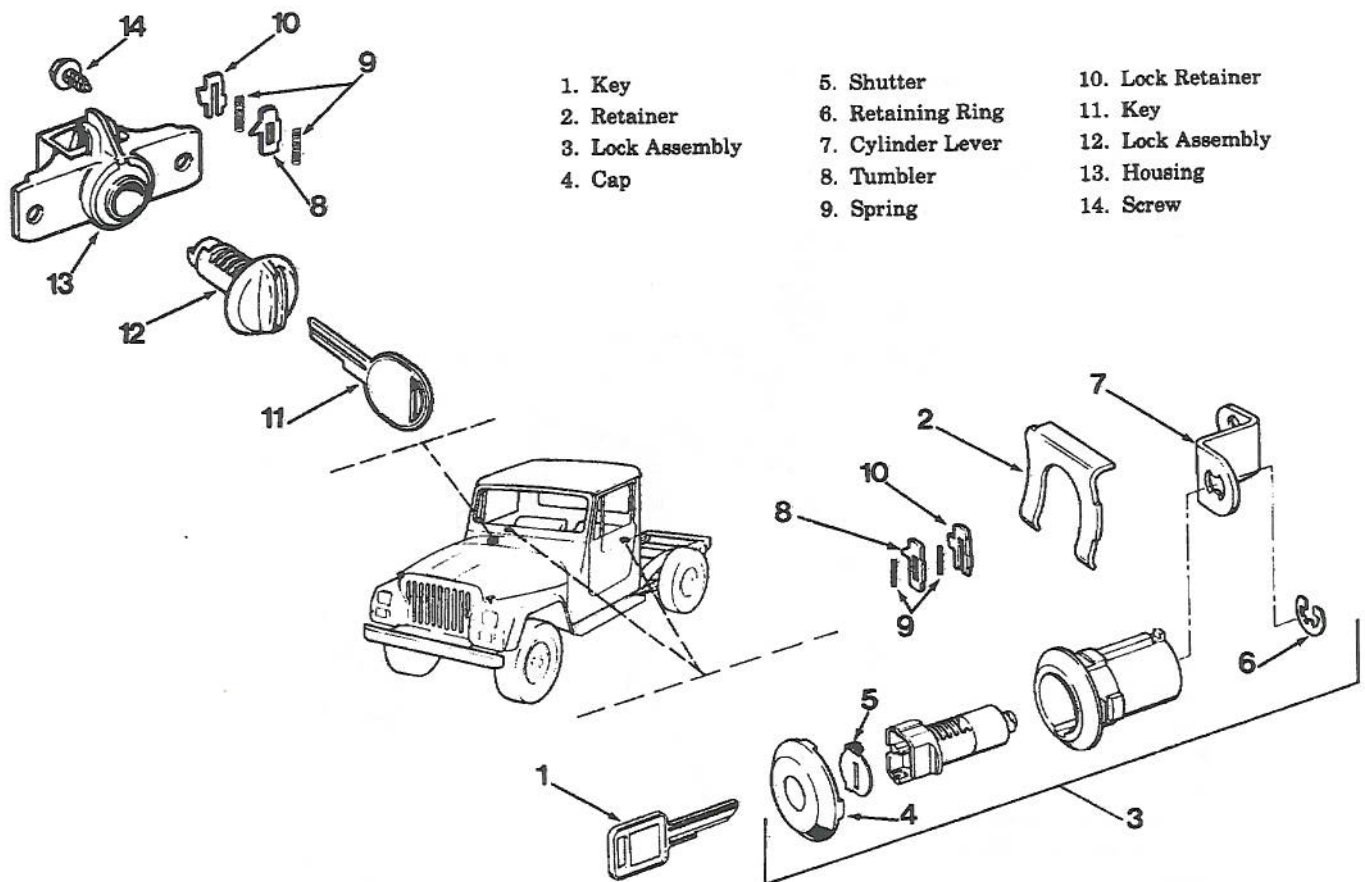


Figure 5-155. Door Handles and Lock Rod Group

- (3) Remove retaining clips and remove lock-to-cylinder rods.
- (4) Remove cylinder retainers (2) and remove lock assemblies (3).
- b. Disassembly. Disassemble locks and keys group as follows:
 - (1) Remove caps (4) and shutters (5).
 - (2) Remove retaining rings (6) and cylinder levers (7).
 - (3) Depress lock retainers (10).
 - (4) Insert keys (1) into cores of lock assemblies (3) and turn slightly.
 - (5) Withdraw keys (1) and cores of door lock assemblies (3).
 - (6) Slowly withdraw keys (1) from cores of lock assemblies (3), releasing tumblers (8) one at a time. Remove each tumbler (8), lock retainer (10) and spring (9).
 - (7) Depress lock retainer (10) in glove box lock assembly (12).
 - (8) Insert key (11) into lock assembly (12) and turn slightly.
 - (9) Withdraw key (11) and lock assembly (12).



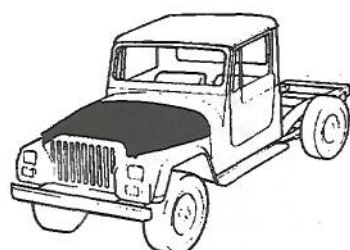
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Figure 5-156. Locks and Keys Group

- (10) Slowly withdraw key (11) from glove box assembly (12), releasing tumblers (8) one at a time. Remove each tumbler (8), lock retainer (10) and lock spring (9).
- (11) Remove screws (14) and remove housing (13).
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- d. Repair and replacement. Replace all worn or damaged parts.
- e. Assembly. Assemble locks and keys group as follows:
 - (1) Install housing (13) using screws (14).
 - (2) Install each tumbler (8), lock retainer (10) and spring (9) in lock assembly (12).
 - (3) Insert key (11) in lock assembly (12).
 - (4) Depress lock retainer (10) and insert key (11) and lock assembly (12) into lock housing (13). Remove key (11).
 - (5) Install tumblers (8), lock retainers (10) and springs (9) in cores of lock assemblies (3).
 - (6) Insert key (1) into cores of lock assemblies (3).
 - (7) Depress lock retainers (10) and insert key (1) and core of lock assembly (3) into lock assembly (3).
 - (8) Remove key (1).
 - (9) Install cylinder levers (7) and retaining rings (6).
 - (10) Install shutters (5) and caps (4).
- f. Installation. Install lock and key group as follows:
 - (1) Install door lock assemblies (3) and cylinder retainers (2).
 - (2) Attach lock-to-cylinder rods and install retaining clips.
 - (3) Install door latches cover using screws.
 - (4) Install watershield paper and door trim panels.

5-5.9.11 *Hood and Hinges Group*. Refer to figure 5-157, and perform the following steps to overhaul the hood and hinges group.

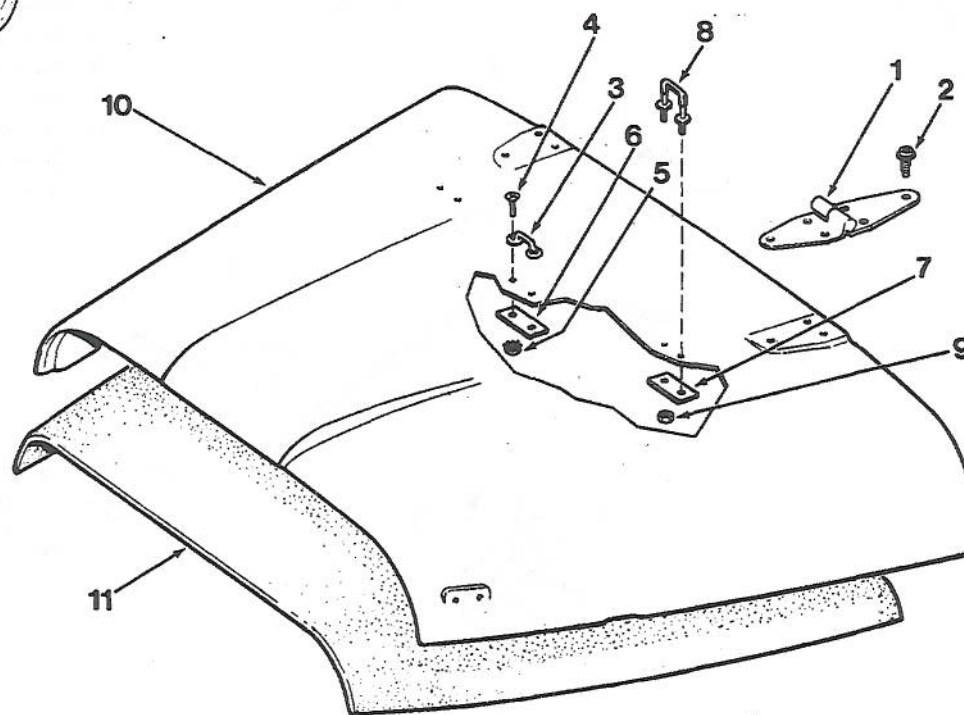
- a. Removal. Remove hood and hinges group as follows:
 - (1) Mark position of hinges on mounting panels before removing hood.
 - (2) Remove screws and washers (2) and hinge assemblies (1).
 - (3) Remove hood weldment assembly (10).
- b. Disassembly. Disassemble hood and hinges group as follows:
 - (1) Remove screws (4), footman loop (3), nuts and washers (5) and reinforcement (6).
 - (2) Remove self-locking nut (9), U-bolts (8) and reinforcements (7).
 - (3) Remove pad (11).
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- d. Repair and replacement. Replace all worn or damaged parts.
- e. Assembly. Assemble hood and hinges group as follows:
 - (1) Install pad (11).
 - (2) Install reinforcements (7), U-bolts (8) and self-locking nut (9).
 - (3) Install footman loop (3), screws (4), reinforcement (6) and nuts and washers (5).
- f. Installation. Install hood and hinges group as follows:
 - (1) Position hood weldment assembly (10) and align hinge assemblies (1) with alignment marks made during removal.



1. Hinge Assemblies
2. Screws and Washers
3. Footman Loop

4. Screw
5. Nut and Washer
6. Reinforcement
7. Reinforcement

8. U-Bolt
9. Self-Locking Nut
10. Hood Weldment Assembly
11. Pad



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Figure 5-157. Hood and Hinges Group

- (2) Install screws and washers (2).
- (3) Check alignment of hood. Loosen screws and washers (2) and correct alignment, if necessary.

5-5.9.12 *Hood Latch, Prop Rod and Holddown Group*. Refer to figure 5-158, and perform the following steps to overhaul the hood latch, prop rod and holddown group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove the hood latch, prop rod and holddown group as follows:

- (1) Remove screws and washers (9) from hook (11).
- (2) Remove hook (11) and spring (10).
- (3) Remove screws and washers (2), bracket (1) and rod (3).
- (4) Remove rod (3) from bracket (1).
- (5) Remove bracket (7).

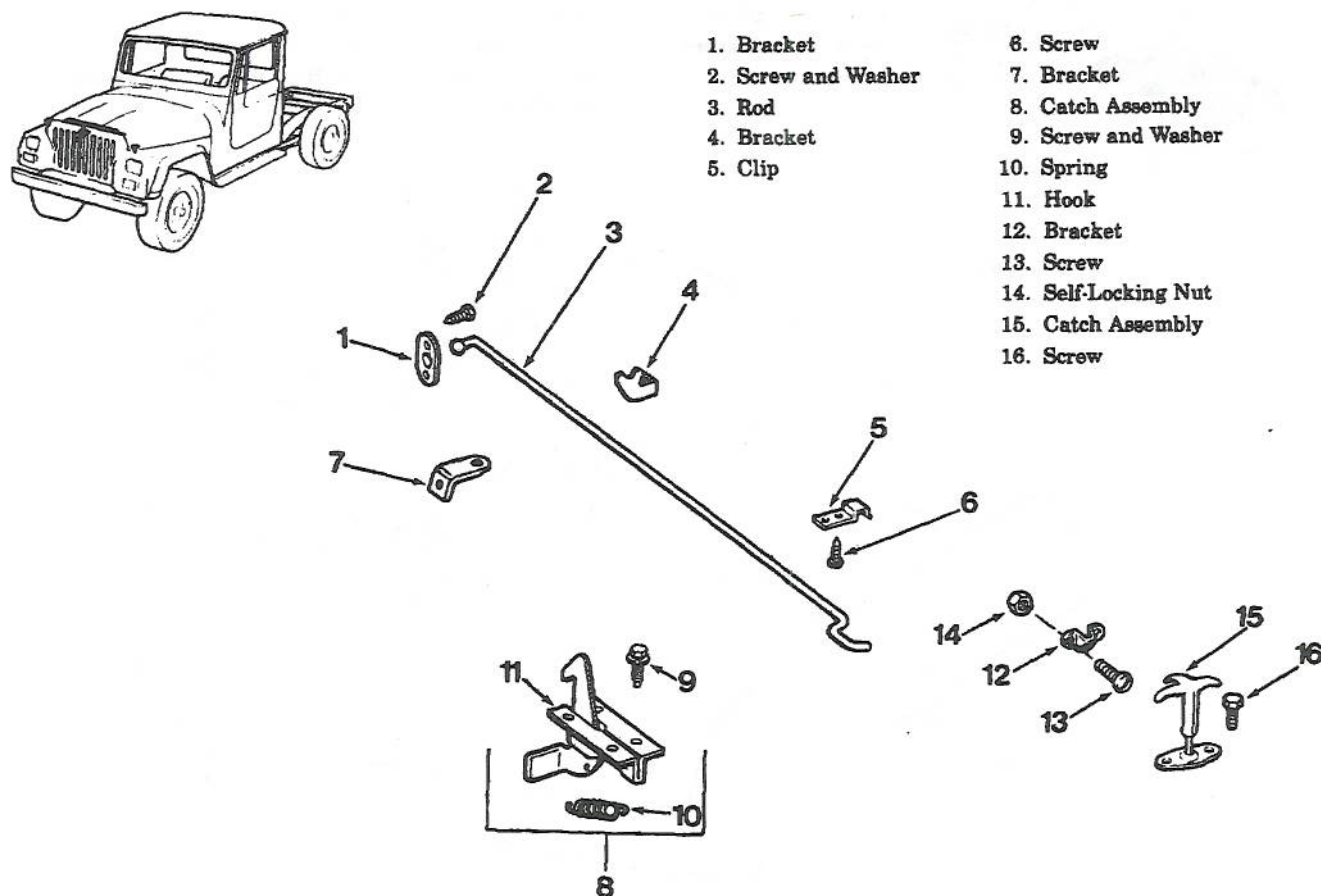
- (6) Remove bracket (4).
- (7) Remove screw (6) and clip (5).
- (8) Remove screw (13), self-locking nut (14) and bracket (12).
- (9) Remove capscrews (16) and catch assembly (15).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install hood latch, prop rod and holddown group as follows:

- (1) Install catch assembly (15) using capscrews (16).
- (2) Install bracket (12) using screw (13) and self-locking nut (14).



09823B

Figure 5-158. Hood Latch, Prop Rod and Holddown Group

- (3) Install clip (5) using screw (6).
- (4) Install bracket (4).
- (5) Install bracket (7).
- (6) Install rod (3) in bracket (1).
- (7) Install bracket (1) on vehicle using screw and washer (2).
- (8) Install hook (11) and spring (10) using screws and washers (2).

5-5.9.13 *Hard Top Enclosure*. Refer to figure 5-159, and perform the following steps to overhaul the hard top enclosure.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove hard top enclosure as follows:

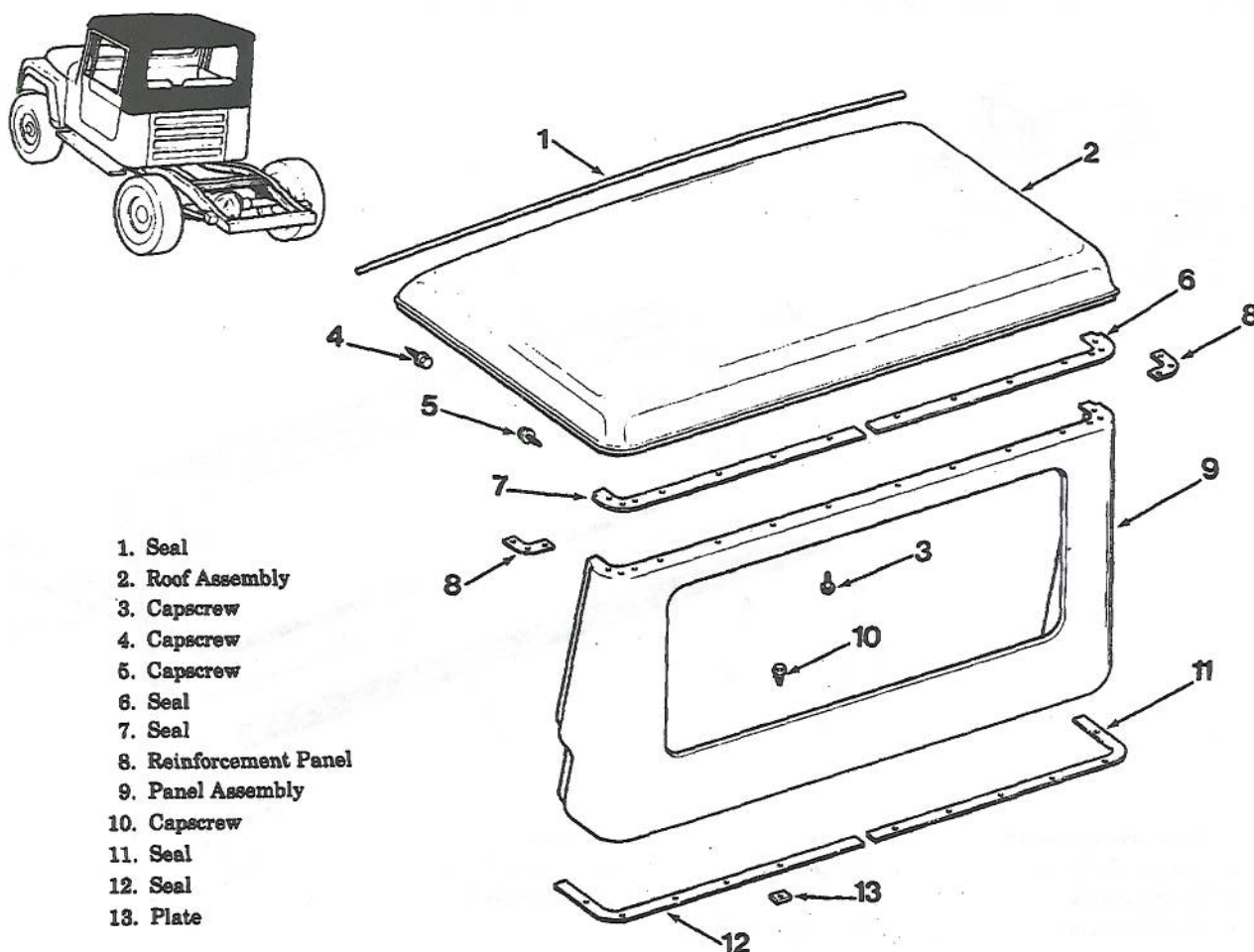
- (1) Disconnect interior dome lamp.

- (2) Remove capscrews (3), (4) and (5) and roof assembly (2).
- (3) Remove seals (1), (6) and (7).
- (4) Remove reinforcements (8).

CAUTION

When removing hard top enclosure, avoid damaging foam seals installed between the panel assembly and the rear body panel.

- (5) Remove capscrews (10) and panel assembly (9).
- (6) Remove seal (11), seal (12) and plate (13).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.



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Figure 5-159. Hard Top Enclosure

- c. Repair and replacement. Replace all worn or damaged seals or capscrews. Replace or repair the roof assembly (2) and panel assembly (9) if damaged. Refer to paragraphs 5-8 and 5-11 for general repair and painting procedures.
- d. Assembly and installation. Assembly is accomplished during installation. Install the hard top enclosure as follows:

CAUTION

When installing hard top enclosure, avoid damaging foam seals installed between the panel assembly and the rear body panel.

- (1) Install plate (3) and seals (11) and (12).
- (2) Install panel assembly (9) using capscrews (10).
- (3) Install reinforcements (8).
- (4) Install seal (1), seal (6) and seal (7).

- (5) Install capscrews (3), (4) and (5) and roof assembly (2).

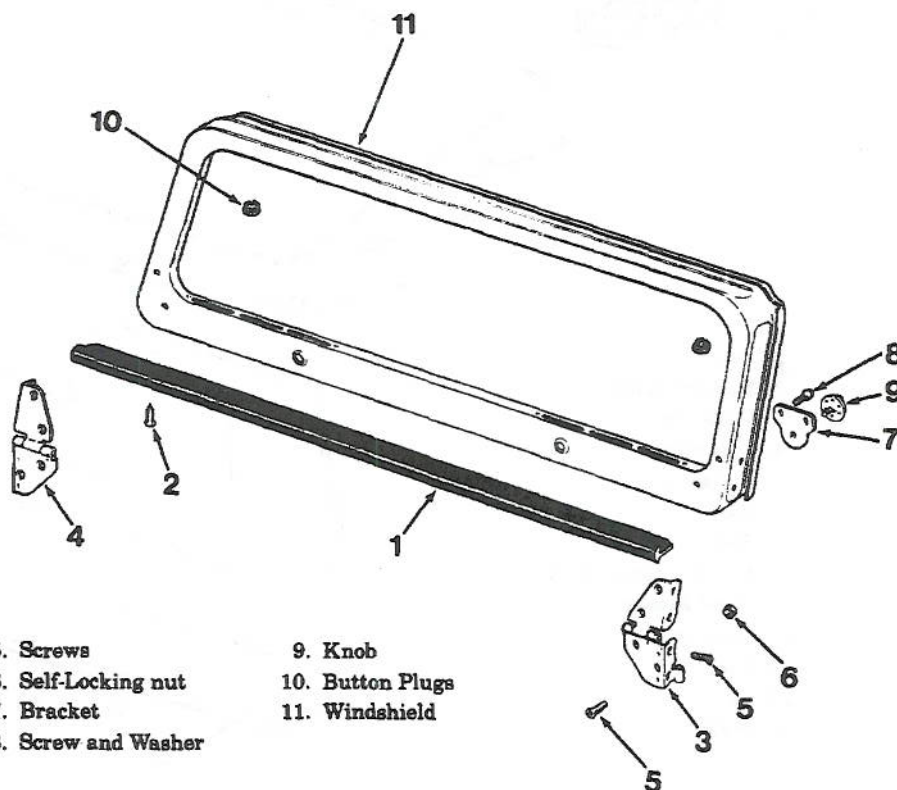
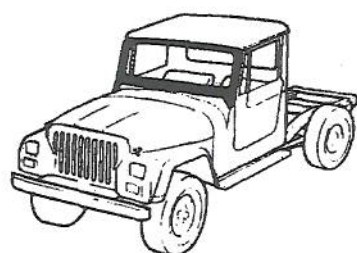
- (6) Connect interior dome lamp.

5-5.9.14 *Windshield Frame Group*. Refer to figure 5-160, and perform the following steps to overhaul the windshield frame group.

- a. Removal. Remove windshield frame group as follows:

- (1) Disconnect wiper motor wiring harness from switch.
- (2) Remove screws (5) and self-locking nuts (6) attaching windshield assembly (11) to vehicle using torx bit tool #J-25359-C.
- (3) Remove screw and washer (8), knobs (9) and bracket(7).

- b. Disassembly. Disassemble windshield frame group as follows:



09861B

Figure 5-160. Windshield Frame Group

- (1) Remove screws (5) and selflocking nuts (6) attaching left and right hinge assemblies (3) and (4) to windshield assembly (11).
 - (2) Remove screws and washers (2) and weatherstrip assembly (1).
 - (3) Remove button plugs (10).
 - c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
 - d. Repair and replacement. Replace all worn or damaged parts.
 - e. Assembly. Assemble windshield assembly as follows:
 - (1) Install button plugs (10).
 - (2) Install weatherstrip assembly (1), using screws and washers (2), on windshield assembly (11).
 - (3) Install left and right hinge assemblies (3) and (4) using screws (5) and selflocking nuts (6).
 - f. Installation. Install windshield frame group as follows:
 - (1) Install holddown bracket (7) and knobs (9) using screws and washers (8).
 - (2) Install windshield assembly (11) to vehicle using screws (5) and self-locking nuts (6). Tighten machine screws (5) using torx bit tool #J-25359-C.
 - (3) Reconnect wiper motor wiring harness to switch.
- 5-5.9.15 Window Seals Group.** Refer to figure 5-161, and perform the following steps to overhaul the window seals group.
- a. Removal and disassembly. Disassembly is accomplished during removal. Remove window seals group as follows:
 - (1) Remove right door trim panel and watershield.
 - (2) Remove glass down-stop.
 - (3) Remove screws attaching guide channel to plastic fasteners; remove guide channel and plastic fasteners. Lower glass to bottom of door.
 - (4) Remove weatherstrip assembly (3) right, (4) left and remove outer weatherstrip assembly (5).
 - (5) Remove channel (6) and weatherstrip (7).
 - (6) Use the same procedures when removing the window seals from the left door.
 - (7) Refer to paragraph 5-5.9.16 and remove windshield and rear window glass.
 - (8) Starting at top of windshield frame, pull weatherstrip (2) away from flange while gently pushing out on glass.
 - (9) Starting at top of rear window frame, pull weatherstrip (2) away from flange while gently pushing out on glass.
 - b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
 - c. Repair and replacement. Replace all worn or damaged parts.
 - d. Assembly and installation. Assembly is accomplished during installation. Install window seals group as follows:
 - (1) Apply a 1/16-inch bead of bedding and glazing compound (32, table 5-1) completely around windshield weatherstrip (2) in flange cavity.
 - (2) Install weatherstrip (2) on glass, centering split in weatherstrip (2) on bottom of glass.
 - (3) Beginning at bottom of glass, work weatherstrip (2) over flange using fingers or piece of wood.
 - (4) Apply windshield sealer, or equivalent between weatherstrip and outside of glass around entire perimeter.
 - (5) Clean off excess sealer.
 - (6) Use the same procedure when installing rear window weatherstrip (1).
 - (7) Install weatherstrip (7) and channel (6) in right door.
 - (8) Install weatherstrip assembly (3) right, (4) left and outer weatherstrip assembly (5) on bottom of window.
 - (9) Install guide channel and plastic fasteners using screws.
 - (10) Install glass down-stop.
 - (11) Install right door trim panel and watershield.
 - (12) Use the same procedure when installing window seals on left door.

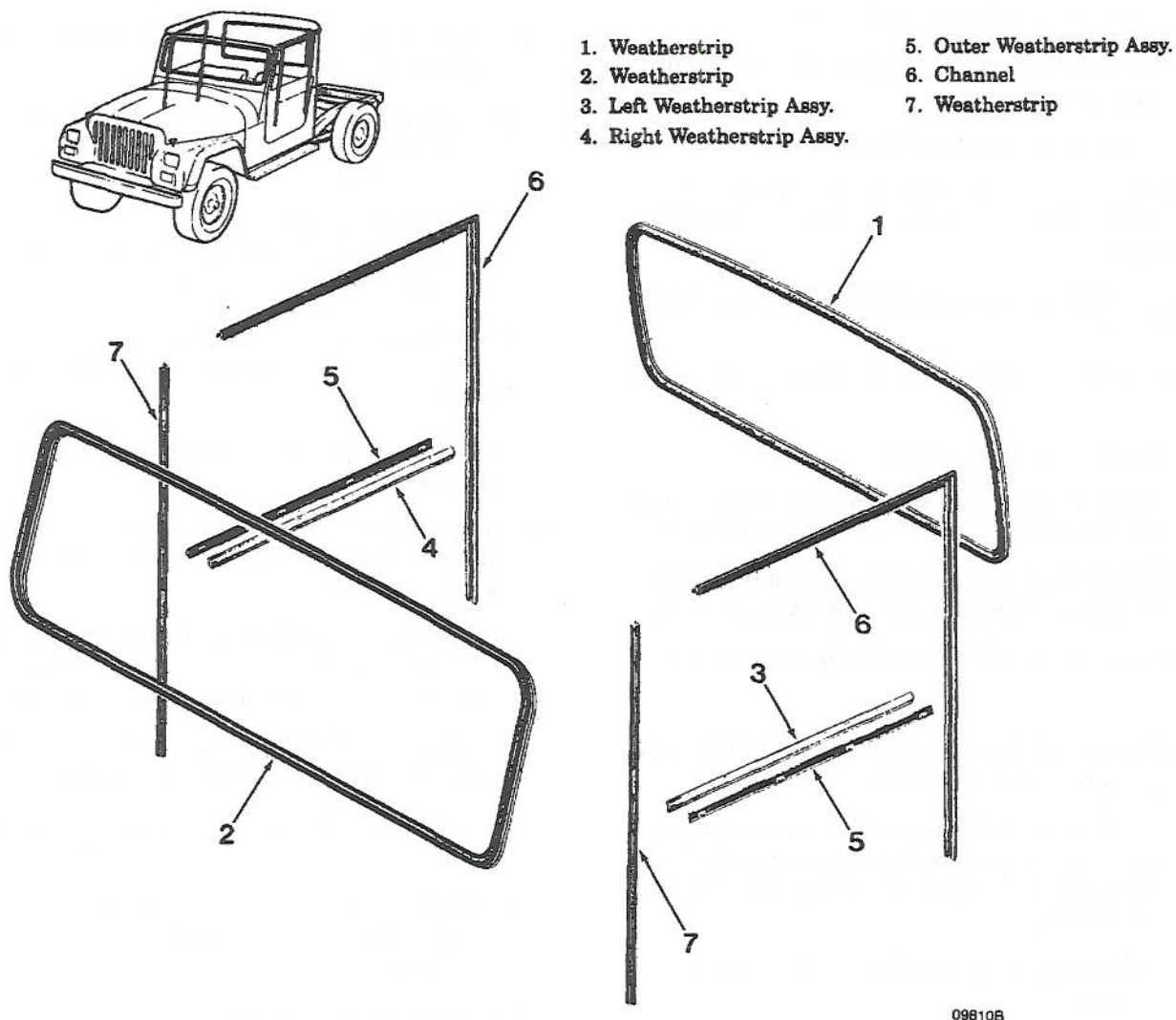
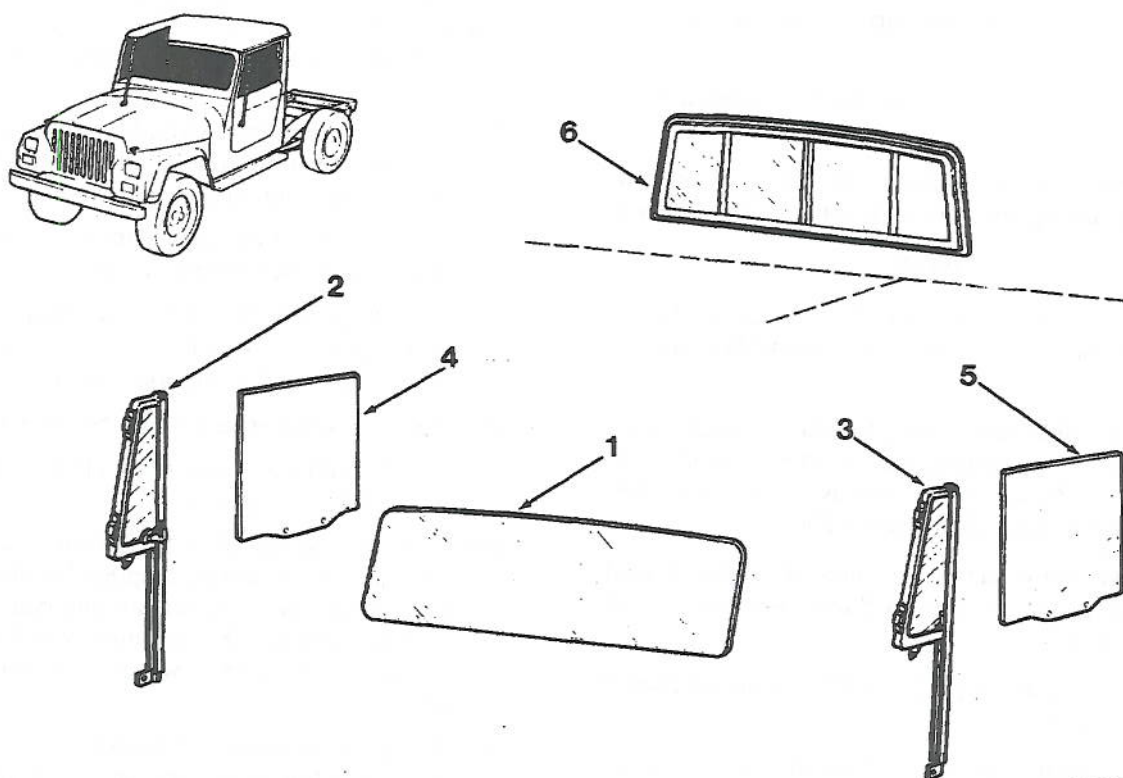


Figure 5-161. Window Seals Group

5-5.9.16. *Glass Group*. Refer to figure 5-162, and perform the following steps to overhaul the glass group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove glass as follows:

- (1) Remove windshield assembly (1) by performing steps (2) through (8).
- (2) Cover adjoining painted surfaces to protect finish.
- (3) Refer to paragraph 5-5.9.20 and remove windshield wiper arms.
- (4) Refer to paragraph 5-5.10.10 and remove sun visor.
- (5) Refer to paragraph 5-5.10.9 and remove rear view mirror.
- (6) Refer to paragraph 5-5.10.15 and remove defroster ducts.
- (7) Refer to paragraph 5-5.9.15 and remove windshield seals, starting at top of windshield frame.
- (8) Gently push out glass windshield assembly (1).
- (9) Remove rear window assembly (6) by performing steps (10) through (12).
- (10) Refer to paragraph 5-5.9.15 and remove rear window seals. Use fiber stick to break seal



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- | | |
|------------------------------------|--------------------------|
| 1. Windshield Assembly | 4. Right-Hand Door Glass |
| 2. Right-Hand Vent Window Assembly | 5. Left-Hand Door Glass |
| 3. Left-Hand Vent Window Assembly | 6. Rear Window Assembly |

Figure 5-162. Glass Group

between window assembly and rubber window seal.

- (11) Push rear window assembly (6) and window seal toward outside of vehicle.
- (12) Remove rear window assembly (6) and window seal.

NOTE

Removal procedures for the left and right vent window assemblies and door glass are identical.

- (13) Remove right-hand vent window assembly (2), left-hand vent window assembly (3), right-hand door glass (4) and left-hand door glass (5) by performing steps (14) through (20).
- (14) Refer to paragraph 5-5.10.8 and remove door trim panel.

- (15) Refer to paragraph 5-5.9.5 and remove water-shield.

- (16) Refer to paragraph 5-5.10.7 and remove glass down-stop, guide channel and plastic fasteners.

- (17) Lower door glass to bottom of door.

- (18) Refer to paragraph 5-5.9.15 and remove 3 inches of window seal from upper door frame.

- (19) Lower right-hand vent window assembly (2) and left-hand vent window assembly (3) and remove.

- (20) Slide right-hand door glass (4) and left-hand door glass (5) out of rear channel and remove by pulling up and out of door.

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures. In addition, perform the following step:

- (1) Refer to paragraph 5-5.9.15 and clean window seals from window assembly cavity and flange cavity using general purpose adhesive cleaner (33, table 5-1).
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install glass as follows:

NOTE

Installation procedures for the left and right door glass and vent window assemblies are identical.

- (1) Install right-hand door glass (4), left-hand door glass (5), right-hand vent window assembly (2) and left-hand vent window assembly (3) by performing steps (2) through (10).
- (2) Lower right-hand door glass (4) and left-hand door glass (5) into door and position in rear channel.
- (3) Refer to paragraph 5-5.10.7 and install plastic fasteners.
- (4) Slide right-hand door glass (4) and left-hand door glass (5) down to bottom of door panel.
- (5) Lower right-hand vent window assembly (2) and left-hand vent window assembly (3) into door and position securely in channel.
- (6) Refer to paragraph 5-5.9.15 and install window seals in upper door frame.
- (7) Refer to paragraph 5-5.10.7 and install guide channel and glass down-stop.
- (8) Check operation of right-hand door glass (4), left-hand door glass (5), right-hand vent window assembly (2) and left-hand vent window assembly (3).
- (9) Refer to paragraph 5-5.9.5 and install windshield.
- (10) Refer to paragraph 5-5.10.8 and install door trim panel.
- (11) Install rear window assembly (6) by performing steps (12) through (17).
- (12) Refer to paragraph 5-5.9.15 and install window seals on rear window assembly (6).
- (13) Insert 1/4 inch cord completely around window seal in flange cavity.

NOTE

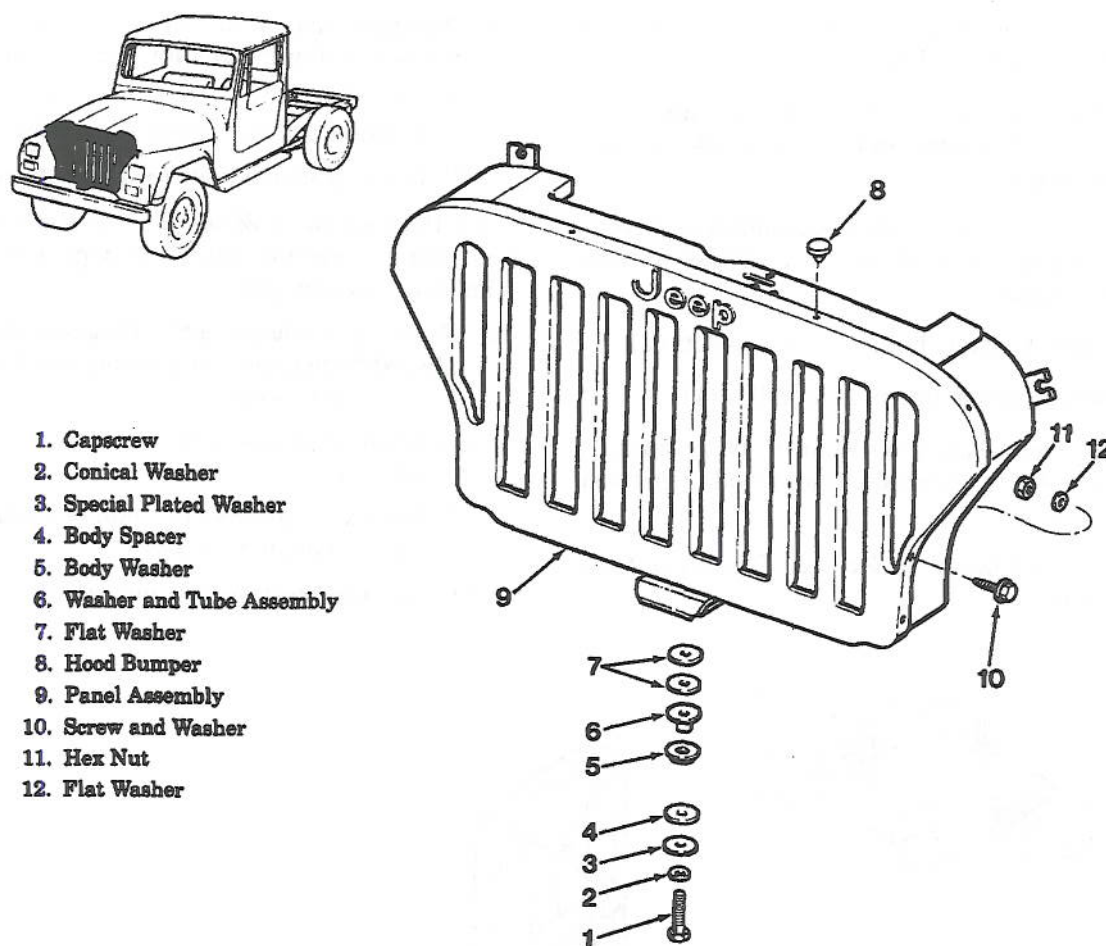
The ends of the cord should hang out over the outside surface of the window assembly approximately in the center of the upper window seal.

- (14) Place rear window assembly (6) and window seal into position in window opening with ends of cord hanging outside vehicle.
- (15) Pull on ends of cord until lip of window seal is over body panel. Remove cord.
- (16) Refer to paragraph 5-5.9.15 and install window seal. Clean excess window sealer from rear window assembly (6) and body surface.
- (17) Test rear window assembly (6) for water leaks.
- (18) Install windshield assembly (1) by performing steps (19) through (27).
- (19) Refer to paragraph 5-5.9.15 and install auto bedding and glazing compound sealer (36, table 5-1) and window seal around edge of windshield assembly. Split in window seal should be centered at bottom of windshield assembly (1) glass.
- (20) Beginning at bottom of windshield assembly (1), work window seal over flange using fiber or wooden wand.

WARNING

Adhesives are flammable and toxic. Avoid prolonged or repeated skin contact. Use only in well-ventilated areas.

- (21) Apply windshield sealer between window seal and outside of glass around entire perimeter of windshield assembly (1).
 - (22) Clean off excess sealer.
 - (23) Refer to paragraph 5-5.10.9 and install rear view mirror.
 - (24) Refer to paragraph 5-5.10.10 and install sun visors.
 - (25) Refer to paragraph 5-5.10.15 and install defroster ducts.
 - (26) Refer to paragraph 5-5.9.20 and install windshield wiper arms.
 - (27) Test windshield assembly (1) for water leaks.
- 5-5.9.17 *Grille Group*. Refer to figure 5-163, and perform the following steps to overhaul the grille group.



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Figure 5-163. Grille Group

a. Removal and disassembly. Disassembly is accomplished during removal. Remove grille group as follows:

- (1) Remove screws and washers (10), hex nuts (11) and flat washers (12).
- (2) Remove capscrew (1), two flat washers (7), washer and tube assembly (6), body washer (4), special plated washer (3) and conical washer (2).
- (3) Remove hood bumper (8).
- (4) Loosen nuts attaching two radiator support rods to radiator grille guard support brackets.
- (5) Remove radiator support rods from brackets.
- (6) Remove grille panel assembly (9) from vehicle.

b. Cleaning and inspection. Refer to paragraphs 5-4.3

and 5-4.4 for general cleaning and inspection procedures.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install grille group as follows:

- (1) Position grille panel assembly (9) in vehicle.
- (2) Connect radiator support rods to grille guard support brackets using nuts.
- (3) Install hood bumper (8).
- (4) Install conical washer (2), special plated washer (3), body spacer (4), body washer (5), washer and tube assembly (6) and flat washer (7).
- (5) Secure grille panel assembly (9) using capscrew (1) and parts (2-7) listed in step (4).

- (6) Install screws and washers (10), hex nuts (11) and flat washers (12).

5-5.9.18 Outside Mirrors Group. Refer to figure 5-164 and perform the following steps to overhaul the outside mirrors group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove outside mirrors group as follows:

- (1) Remove machine bolts (3) and nutserts (2).
- (2) Remove outside mirror assemblies (1).

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

- c. Repair and replacement. Replace all worn or damaged parts.

- d. Assembly and installation. Assembly is accomplished during installation. Install outside mirror group as follows:

- (1) Position outside mirror assemblies (1).
- (2) Install machine bolts (3) and nutserts (2).

5-5.9.19 Windshield Washer Group. Refer to figure 5-165, and perform the following steps to overhaul the windshield washer group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove windshield washer group as follows:

- (1) Remove jet assembly (1), hose (2) and grommet (3).
- (2) Remove capscrews (7), bolt (6), spacer (9) and self-locking nuts (8).
- (3) Remove reservoir (5) and cap (4).

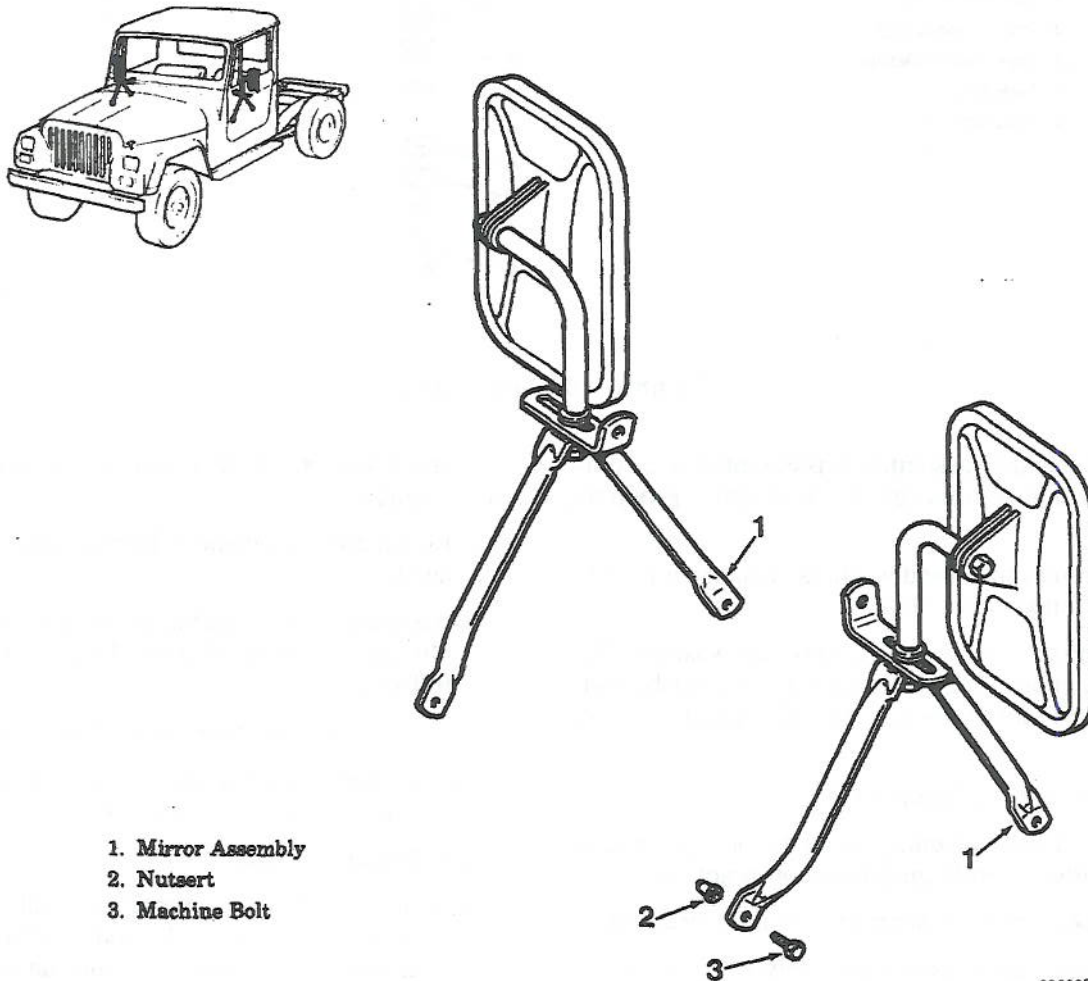
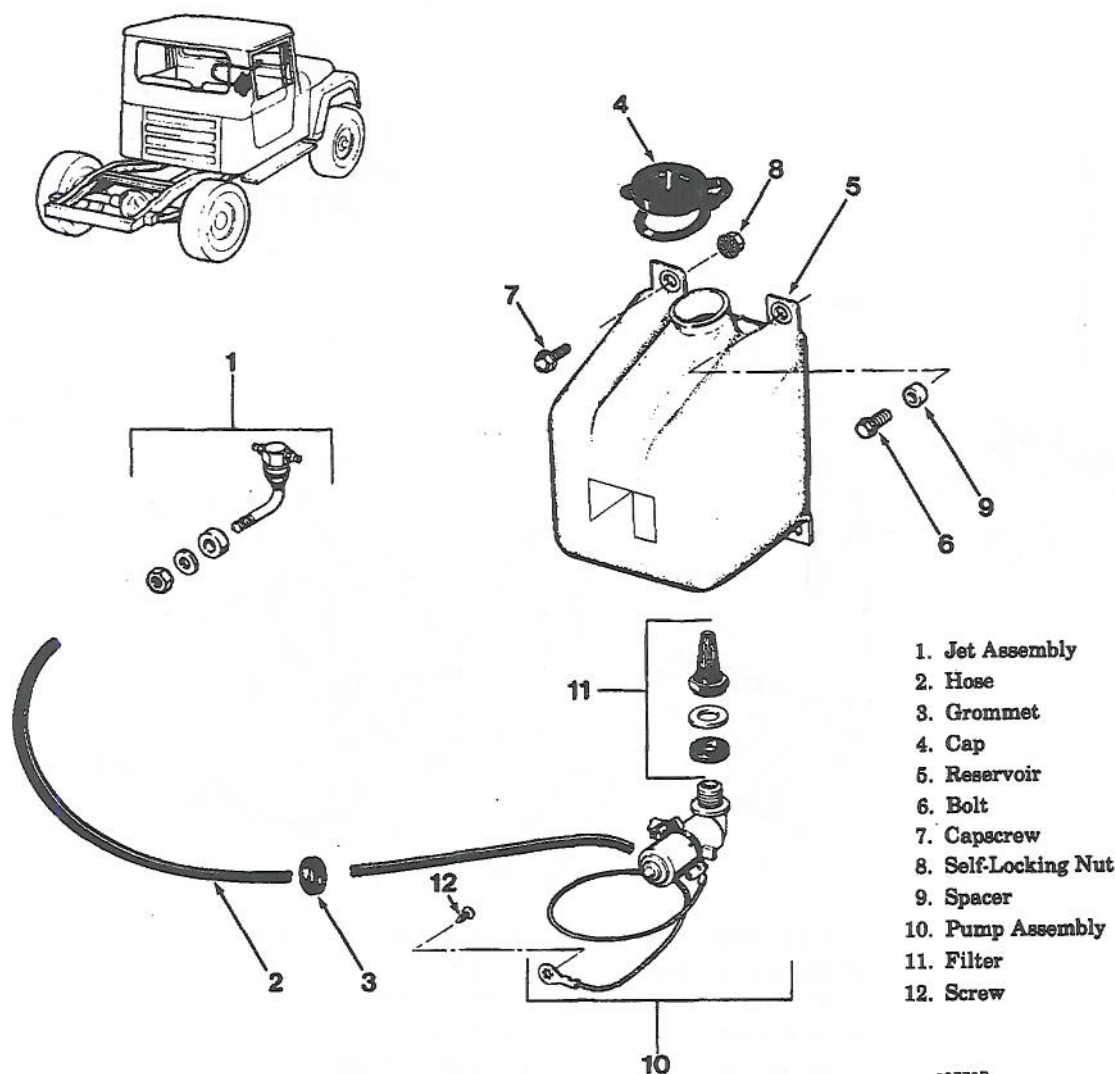


Figure 5-164. Outside Mirrors Group.



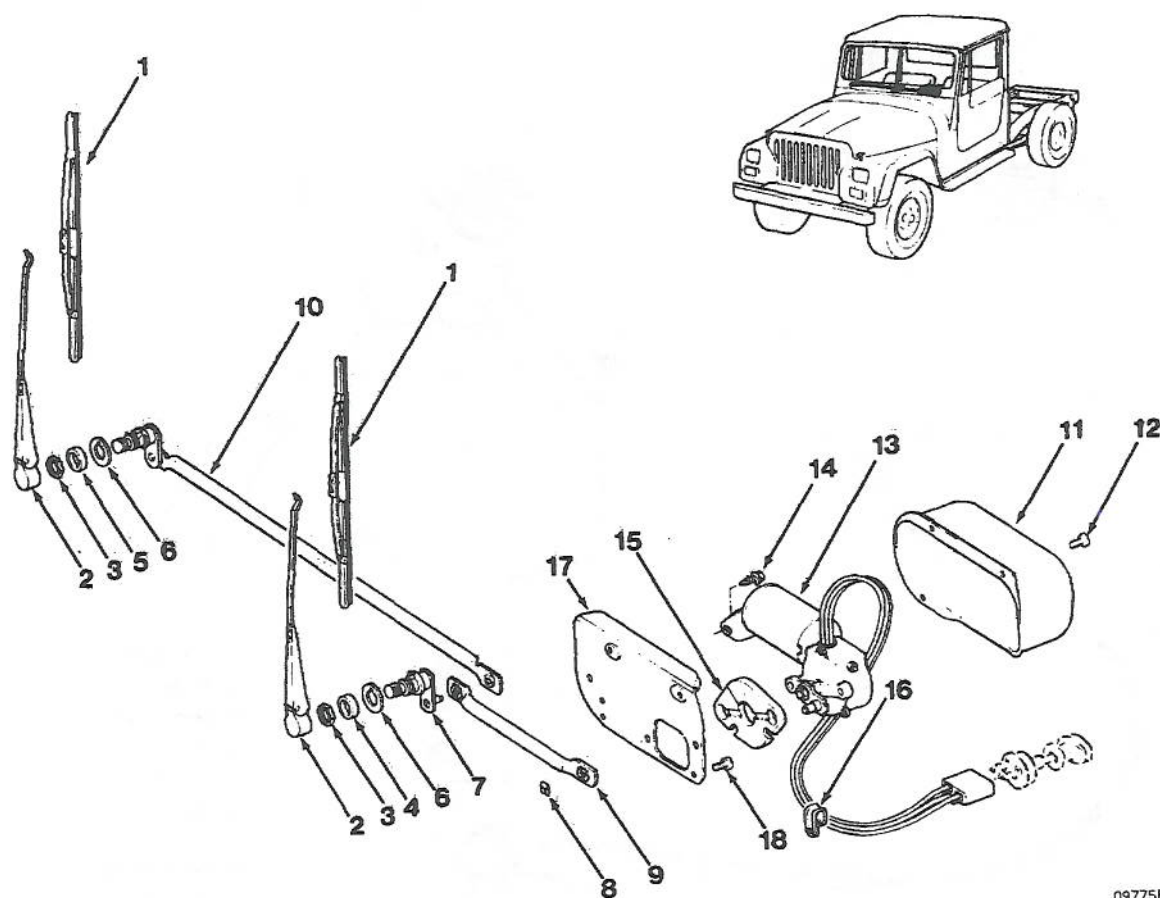
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Figure 5-165. Windshield Washer Group

- (4) Remove filter (11), screw (12) and pump assembly (10).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install windshield washer group as follows:
 - (1) Install pump assembly (10), screw (12) and filter (11).
 - (2) Install reservoir (5) and cap (4).
 - (3) Install capscrews (7), bolt (6), spacer (9) and self-locking nuts (8).
 - (4) Install jet assembly (1), hose (2) and grommet (3).

5-5.9.20 *Windshield Wiper And Motor Group.* Refer to figure 5-166, and perform the following steps to overhaul the windshield wiper and motor group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove windshield wiper group and motor as follows:
 - (1) Remove wiper arm assemblies (2) using remover tool #J-22128.
 - (2) Remove wiper blade (1) from wiper arm assemblies (2).



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1. Wiper Blades
2. Wiper Arm Assembly
3. Hex Nut
4. Escutcheon
5. Escutcheon
6. Outer Spacer
7. Pivot Link
8. Spring Clip
9. Windshield Wiper Link
10. Windshield Wiper Body
11. Motor Cover
12. Machine Screw
13. Wiper Motor
14. Machine Screw
15. Motor Gasket
16. Clamp
17. End Plate Assembly
18. Machine Screw

Figure 5-166. Windshield Wiper and Motor Group

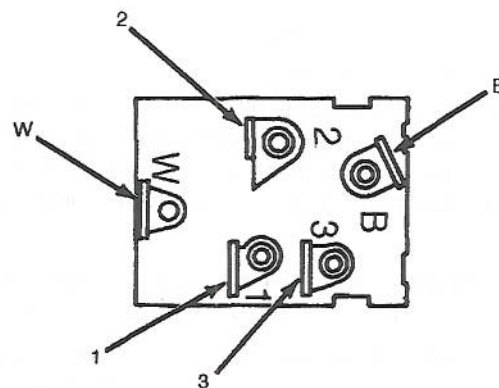
- (3) Remove hex nuts (3), escutcheons (4) and (5) and outer spacers (6).
- (4) Fold windshield down.
- (5) Remove machine screws (12) and wiper motor cover (11).
- (6) Disconnect wiper motor (13) cable from wiper switch.
- (7) Remove clamp (16).
- (8) Remove machine screws (14), wiper motor (13) and motor gasket (15).
- (9) Remove machine screws (18) and plate assembly (17).
- (10) Raise windshield.
- (11) Remove spring clip (8) and remove and disconnect windshield wiper link (9) and windshield wiper body (10).
- (12) Separate pivot link (7) from connecting arm assembly.
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install windshield wiper and motor group as follows:

- (1) Install pivot link (7); connect and position windshield wiper link (9) and windshield wiper body (10).
- (2) Lower windshield and install plate assembly (17) using machine screws (18).
- (3) Install motor gasket (15), wiper motor (13) and spring clip (8) using machine screws (14).
- (4) Install clamp (16).
- (5) Connect wiper motor (13) cable to wiper switch.
- (6) Install wiper motor cover (11) using machine screws (12).
- (7) Raise windshield.
- (8) Install outer spacers (6), escutcheons (4) and (5) and hex nuts (3).
- (9) Install wiper blades (1) in wiper arm assemblies (2).
- (10) Install wiper arm assemblies (2).

- e. Testing. Refer to figure 5-167 and perform the following test procedures:

- (1) With ignition switch on, check for 12 volts at switch terminal B.
- (2) If 12-volt test lamp lights, but wiper motor does not operate, connect jumper wire from ground strap on motor to good body ground.
- (3) If motor still does not operate, disconnect wiring from switch and connect terminals 2 and B with jumper wire.



Selector Position	
Off or Park	B-1
Low Speed	B-2
High Speed	B-3
Wash	B-W

Figure 5-167. Continuity Test for Wiper Switch

- (4) If motor fails to operate at low speed, green wire is broken, there is defective internal motor connection or a low-speed brush is stuck and motor must be replaced.
- (5) To check high-speed operation, connect a jumper wire between terminals 3 and B. If motor fails to operate, red wire is broken, there is a defective internal motor connection or a high-speed brush is stuck and motor must be replaced.
- (6) With wiper blades in a position other than park, connect a jumper wire between terminals 1 and B. The wipers should run on low speed and stop in park. Wiper motor conditions and causes are as follows:

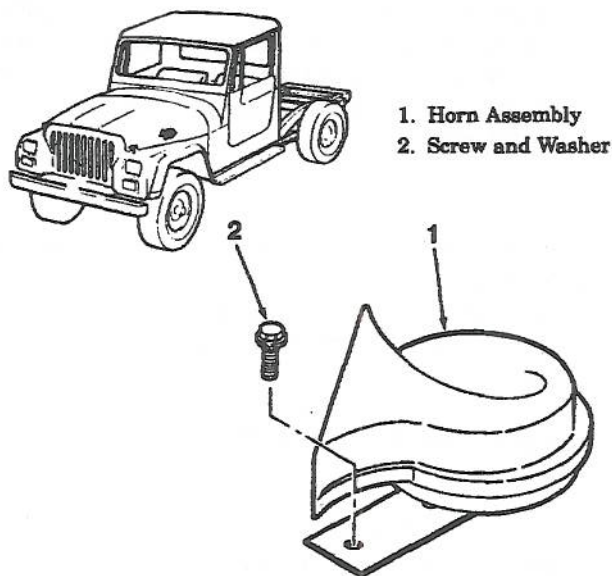
Condition	Cause
Motor doesn't run.	<ol style="list-style-type: none"> (1) Broken black wire. (2) Defective internal motor connection. (3) Defective park point set to low speed brush connection
Motor runs, but doesn't park.	Drive gear cam isn't sufficiently breaking contact point.
Motor operation is intermittent.	<ol style="list-style-type: none"> (1) Defective solder joint. (2) Defective wiring connection. (3) Body ground. (4) Worn brush.

NOTE

The two-speed wiper motor used on this vehicle is not a serviceable unit. Replace the wiper motor only if proper troubleshooting procedures and inspection of all components leads to the diagnosis of internal wiper motor problems.

5-5.9.21 *Horn Group*. Refer to figure 5-168, and perform the following steps to overhaul the horn group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove horn group as follows:
 - (1) Disconnect wiring connector from horn assembly (1).
 - (2) Remove screw and washer (2).
 - (3) Remove horn assembly (1).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Remove horn group as follows:
 - (1) Install horn assembly (1) using screw and washer (2). Tighten screw to torque specified by table 6-2.



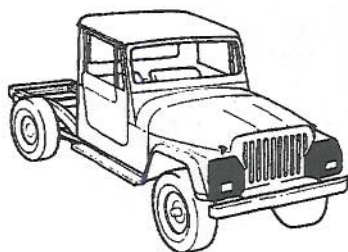
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Figure 5-168. Horn Group

- (2) Connect wiring connector to horn assembly (1).

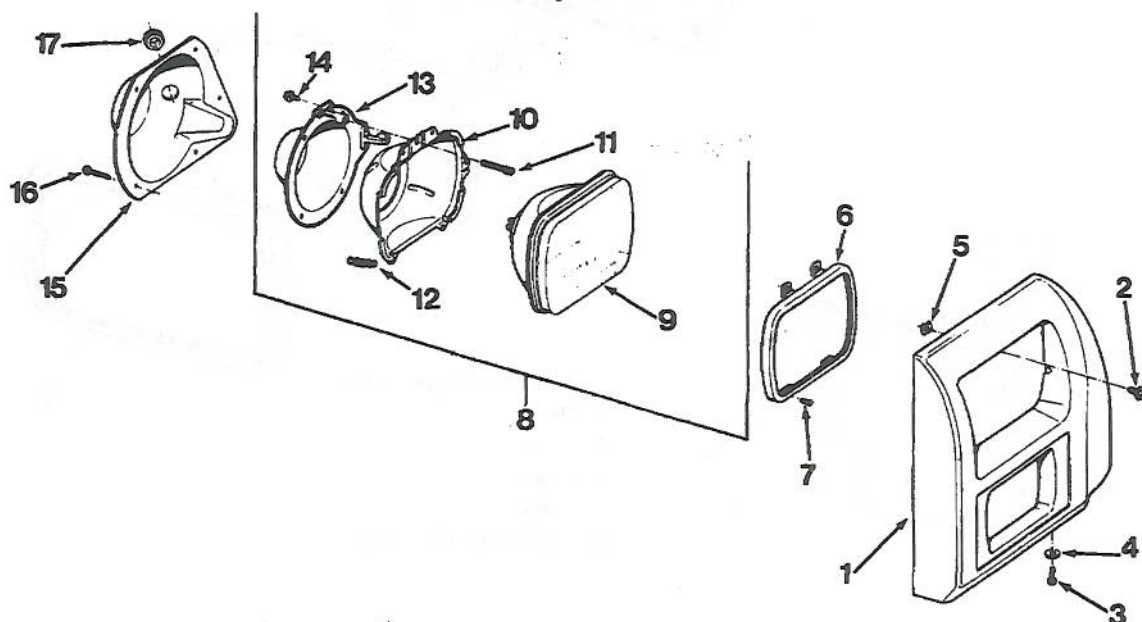
5-5.9.22 *Headlamps Group*. Refer to figure 5-169, and perform the following steps to overhaul the headlamps group.

- a. Removal. Remove headlamps group as follows:
 - (1) Remove oval head screws (2), J-type nuts (5), machine screws (3), nuts and lockwashers (4) and left headlamp bezel (1).
 - (2) Remove retainer screws (7) and retaining ring (6).
 - (3) Pull headlamp assembly (8) out and disconnect wiring assembly.
 - (4) Remove machine screws (16) and left rear cover (15).
 - (5) Remove grommet (17).
 - (6) Follow same procedure when removing right headlamp components.
- b. Disassembly. Disassemble headlamp group as follows:
 - (1) Remove adjusting screws (11) and lamp (9).
 - (2) Remove washer head capscrews (14).
 - (3) Remove mounting shell (10), adjusting spring (12) and mounting body (13).
 - (4) Follow same procedure when disassembling right headlamp assembly.
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- d. Repair and replacement. Replace all worn or damaged parts.
- e. Assembly. Assemble headlamp group as follows:
 - (1) Install mounting body (13), adjusting spring (12) and mounting shell (10) using washer head capscrews (14).
 - (2) Install lamp (9) and adjusting screws (11).
 - (3) Follow same procedure when assembling right headlamp assembly.
- f. Installation. Install headlamp group as follows:
 - (1) Install grommet (17).
 - (2) Install left rear cover (15) using machine screws (16).
 - (3) Connect wiring assembly and install headlamp assembly (8).



1. Left Headlamp Bezel
2. Oval Head Screw
3. Machine Screw
4. Nut and Lockwasher
5. J-Type Nut
6. Retaining Ring
7. Retainer Screw
8. Headlamp Assembly
9. Lamp

10. Mounting Shell
11. Adjusting Screw
12. Adjusting Spring
13. Mounting Body
14. Washer Head Capscrew
15. Left Rear Cover
16. Machine Screw
17. Grommet



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Figure 5-169. Headlamps Group

- (4) Install retaining ring (6) using retainer screws (7).
- (5) Install left headlamp bezel (1) using oval head screws (2), J-type nuts (5) and machine screws (3) and nuts and lockwashers (4).
- (6) Follow same procedure when installing right headlamp components.

5-5.9.23 *Parking And Front Turn Lamps Group.* Refer to figure 5-170, and perform the following steps to overhaul the parking and front turn lamps group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove parking and front turn lamps group as follows:

- (1) Remove screws and remove bezel (2) from left turn signal lamp (1).

- (2) Remove lens (3).

- (3) Remove lamps (4 and 5).

- (4) Remove lamp assembly body (6) and disconnect wire assembly.

- (5) Repeat procedure for right turn signal lamp.

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

- c. Repair and replacement. Replace all worn or damaged parts.

- d. Assembly and installation. Assembly is accomplished during installation. Install parking and front turn lamps as follows:

- (1) Connect wire assembly and install lamp assembly body (6).

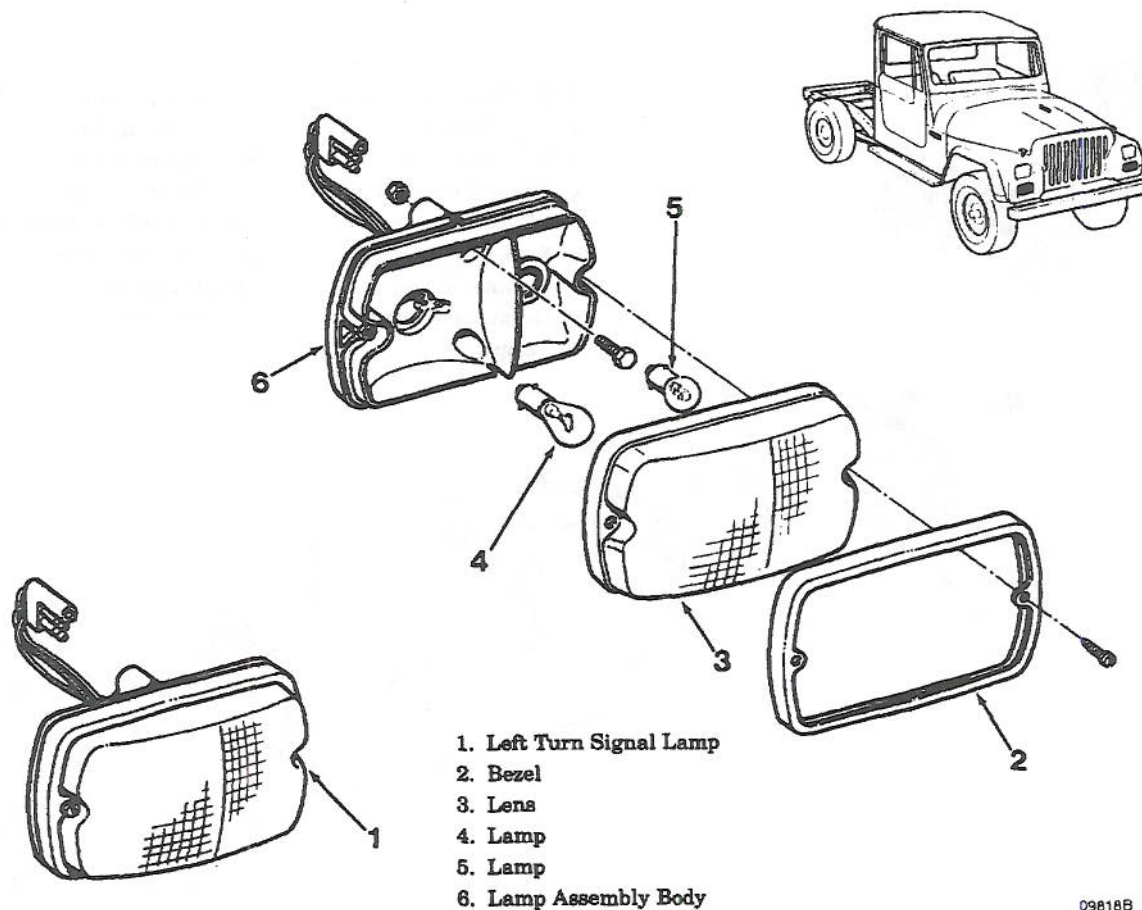


Figure 5-170. Parking and Front Turn Lamps Group

- (2) Install lamps (4 and 5).
- (3) Install lens (3) and bezel (2) on left turn signal lamp (1).
- (4) Repeat procedure for right turn signal lamp.

5-5.9.24 *Harnesses Group*. Refer to figure 5-171, and perform the following steps to overhaul the harnesses group.

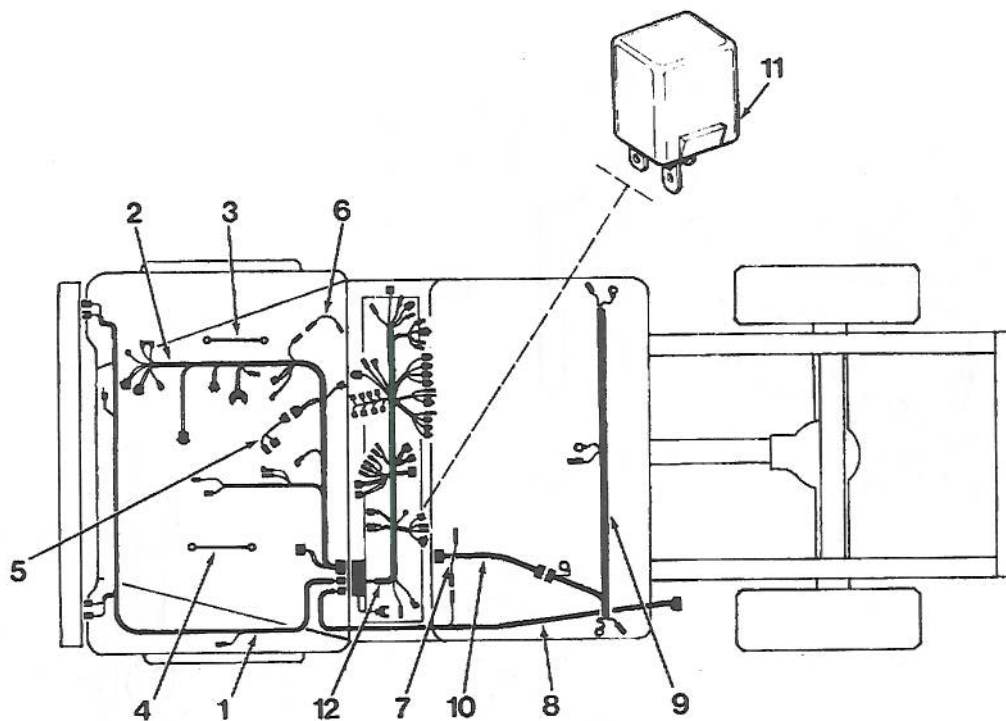
- a. Removal and disassembly. Disassembly is accomplished during removal. Remove harnesses group as follows:

- (1) Disconnect engine compartment harness (1) from head lamp assemblies and from main harness connector and remove.
- (2) Disconnect engine harness (2) from engine components and from main harness connector and remove.
- (3) Remove solenoid and starter cable assembly (3).

- (4) Remove ground strap (4).
- (5) Remove neutral, safety and backup lamp harness (5).
- (6) Remove heater feed cable assembly (6).
- (7) Remove fuel tank sending unit harness assembly (7).
- (8) Remove chassis harness (8).
- (9) Remove roof lamps harness (9).
- (10) Remove roof lamps jumper harness (10).
- (11) Remove horn relay (11).
- (12) Remove instrument relay harness (12).

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

- c. Repair and replacement. Replace all worn or damaged parts.



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- | | |
|--|--|
| 1. Engine Compartment Harness | 7. Fuel Tank Sending Unit Harness Assembly |
| 2. Engine Harness | 8. Chassis Harness |
| 3. Solenoid and Starter Cable Assembly | 9. Roof Lamps Harness |
| 4. Ground Strap | 10. Roof Lamps Jumper Harness |
| 5. Neutral, Safety and Backup Lamp Harness | 11. Horn Relay |
| 6. Heater Feed Cable Assembly | 12. Instrument Relay Harness |

Figure 5-171. Harnesses Group

d. Assembly and installation. Assembly is accomplished during installation. Install harnesses group as follows:

- (1) Install instrument relay harness (12).
- (2) Install horn relay (11).
- (3) Install roof lamps jumper harness (10).
- (4) Install roof lamps harness (9).
- (5) Install chassis harness (8).
- (6) Install fuel tank sending unit harness assembly (7).
- (7) Install heater feed cable assembly (6).
- (8) Install neutral, safety and backup lamp harness (5).
- (9) Install ground strap (4).
- (10) Install solenoid and starter cable assembly (3).
- (11) Connect engine harness (2) to engine components and main harness connector.
- (12) Connect engine compartment harness (1) to headlamp assemblies and main harness connector.

5-5.9.25 *Extendable Hitch Connection Assembly*. Refer to figure 5-172, and perform the following steps to overhaul the extendable hitch connection assembly.

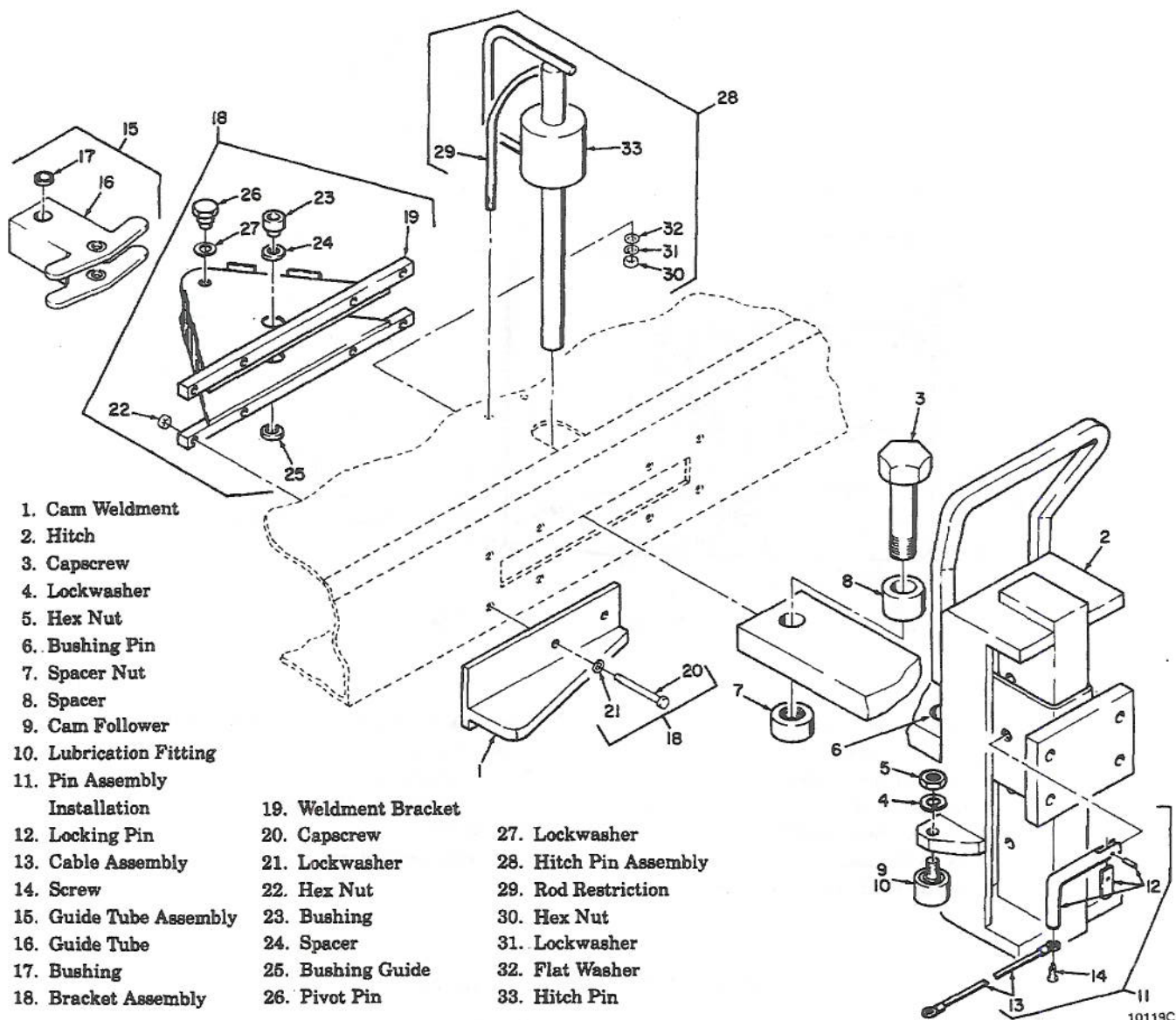


Figure 5-172. Extendable Hitch Connection Assembly

a. Removal and disassembly. Disassembly is accomplished during removal. Remove extendable hitch connection assembly as follows:

- (1) Remove nuts (30), lockwashers (31), washers (32), hitch pin (33) and restriction rod (29) to remove hitch pin assembly (28).
- (2) Remove spacer nut (7), spacer (8) and capscrew (3).
- (3) Remove pin assembly installation (11) by removing locking pin (12), screws (14) and cable (13).
- (4) Carefully slide tongue bar out of bracket assembly (18) and guide tube assembly (15). Remove bushing (6).
- (5) Remove two pivot pins (26), lockwashers (27) and guide tube assembly (15).
- (6) Remove bushing (17) from guide tube (16).
- (7) Remove two hex nuts (5), lockwashers (4) and cam followers (9) from hitch (2). Remove lubrication fittings (10) from cam followers (9).

- (8) Remove bracket assembly (18) by removing hex nuts (22), lockwashers (21) and capscrews (20) to separate weldment bracket (19) and cam weldment (1) from rear bumper.
- (9) Remove bushing (23), spacer (24) and guide (25) from bracket weldment (18).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install extendable hitch connection assembly as follows:
 - (1) Install bushing (23), spacer (24) and guide (25) in bracket weldment (18).
 - (2) Install bracket assembly (18) by attaching weldment bracket (19) and cam weldment (1) to bumper with capscrews (20), lockwashers (21) and hex nuts (22).
 - (3) Install guide tube assembly (15) with two pivot pins (26) and lockwashers (27).
 - (4) Install lubrication fittings (10) in cam followers (9) and install two cam followers (9) on hitch (2) with two hex nuts (5) and lockwashers (4).
 - (5) Install bushing (6) and slide tongue bar end of hitch (2) through bumper and into guide tube assembly (15).
 - (6) Install pin assembly installation (11), locking pin (12), cable (13) and screws (14).
 - (7) Install capscrew (3), spacer (8) and spacer nut (7).
 - (8) Install hitch pin assembly (28) by installing hitch pin (33) and restriction rod (29) with washers (32), lockwashers (31) and nuts (30).

5-5.9.26 *Chassis Conversion Assembly*. Refer to figure 5-173, and perform the following steps to overhaul the chassis conversion assembly.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove chassis conversion assembly as follows:
 - (2) Remove hex nuts (4), lockwashers (3), screws (2) and pintle assembly (1).
 - (2) Remove hex nuts (8), lockwashers (7), screws (6) and pintle assemblies (5).
 - (3) Remove hex nut (10), lockwasher (11) and eye bolt (9).

- (4) Remove hex nuts (15), lockwashers (14), capscrews (13) and pintle assembly (12).
- (5) Loosen nuts on hanger (17) and remove elbow (18) and spark arrestor (16).
- (6) Support front bumper (20) with suitable blocking or lifting device and remove hex nuts, lockwashers, capscrews and front bumper (20).
- (7) Support rear bumper (21) with suitable blocking or lifting device and remove capscrews (36). Remove rear bumper (21).
- (8) Refer to paragraph 5-5.9.25 and remove extendable hitch connection assembly (19).
- (9) Raise hood and remove relay (22) located under horn mounting bolt.

WARNING

Do not work under the body weldment while it is detached or raised from vehicle without first supporting it with safety jack stands device, or personal injury may result.

- (10) Attach suitable lifting device to body weldment portion of body assembly (23) and remove all attaching nuts, lockwashers, washers and capscrews.
- (11) Lift body weldment from vehicle using lifting device, place in suitable work area and remove lifting device.
- (12) Remove sending unit cover (24).
- (13) Remove hex nuts, lockwashers, washers, capscrews and front steps (25) and (26).
- (14) Remove attaching rivets and separate tool box lid (27).
- (15) Refer to paragraph 5-5.1.32 and remove fuel tank assembly (32).
- (16) Refer to paragraph 5-5.10.29 and remove electrical assembly installations (33).
- (17) Remove tool box and remove ballast assembly (30) and ballast mounting assembly (31).
- (18) Remove capscrews (36) and rub rails (34) and (35).
- (19) Remove blind rivets (29) and skid plate (28).
- (20) Refer to appropriate paragraphs in Chapter 5 of this manual and remove cab and chassis components (37) as required.

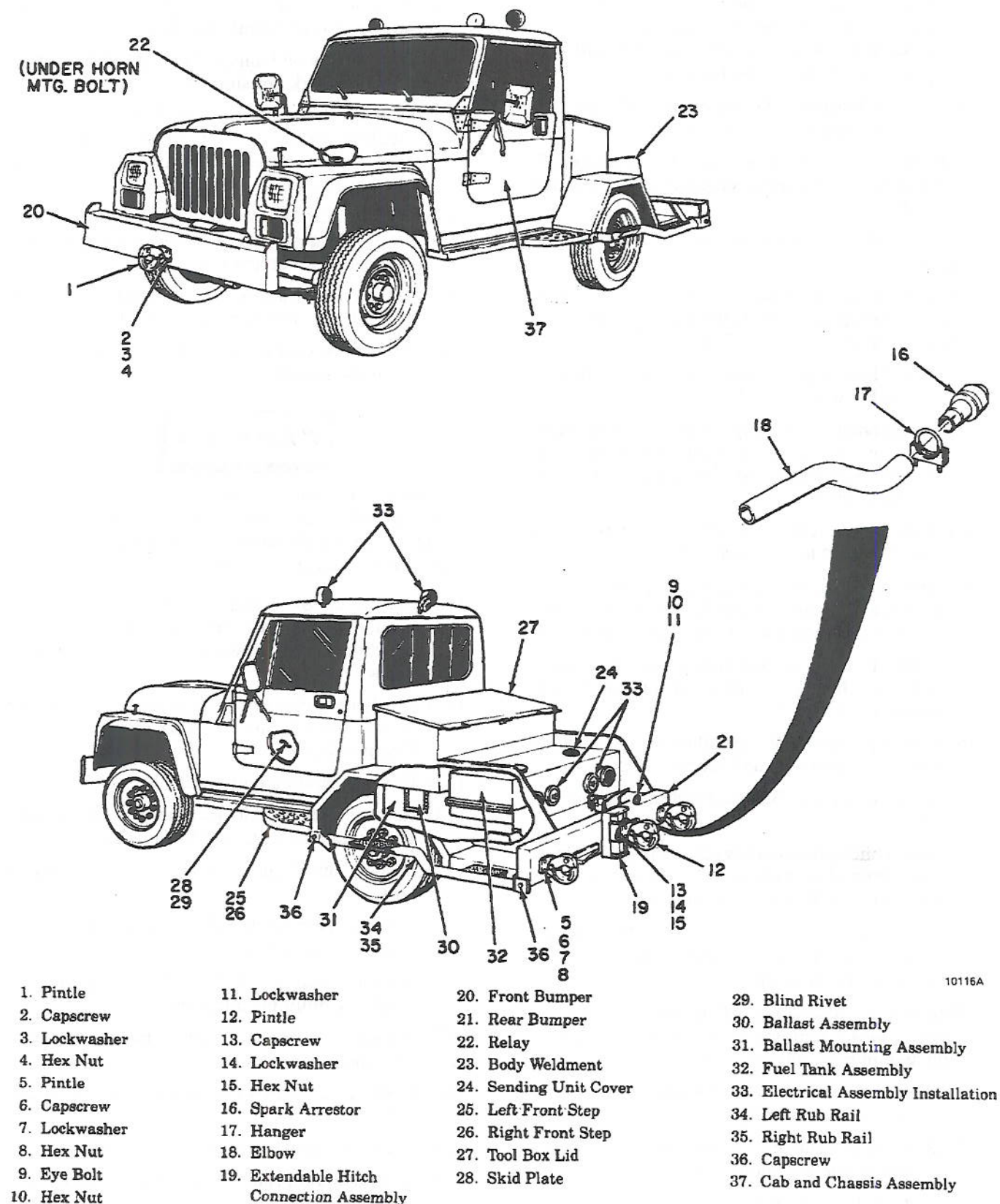


Figure 5-173. Chassis Conversion Assembly

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for cleaning and inspection procedures. In addition, check to see that pintles (5) and (12) lock securely and are free of excessive wear or damage.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install chassis conversion kit as follows:
 - (1) Refer to appropriate paragraphs of Chapter 5 of this manual and install cab and chassis components (37) as required.
 - (2) Install skid plate (28) using blind rivets (29).
 - (3) Install subrails (34) and (35) using capscrews (36).
 - (4) Install ballast assembly (30) and ballast mounting assembly (31) and install tool box.
 - (5) Refer to paragraph 5-5.10.29 and install electrical assembly installations (33).
 - (6) Refer to paragraph 5-5.1.32 and install fuel tank assembly (32).
 - (7) Install tool box lid (27) using rivets.
 - (8) Install steps (25) and (26) using capscrews, washers, lockwashers and hex nuts.
 - (9) Install sending unit cover (24).
 - (10) Position body weldment portion of body assembly (23) using suitable lifting device and install using capscrews, washers, lockwashers and nuts.
 - (11) Raise hood and install relay (22) under horn mounting bolt.
 - (12) Refer to paragraph 5-5.9.25 and install extendable hitch connection assembly (19).
 - (13) Position rear bumper (21) using suitable lifting device and install using capscrews (36).

- (14) Position front bumper (20) using lifting device and install using capscrews, lockwashers and hex nuts.
- (15) Install spark arrester (16) and elbow (18) using hanger (17).
- (16) Install pintle assembly (12) using capscrews (13), lockwashers (14) and hex nuts (15).
- (17) Install eyebolt (9), lockwasher (11) and hex nut (10).
- (18) Install pintle assemblies (5) using screws (6), lockwashers (7) and hex nuts (8).
- (19) Install pintle assembly (1) using screws (2), lockwashers (3) and hex nuts (4).

5-5.10. Cab Interior

5-5.10.1 *Front Seat Frame And Pad Group.* Refer to figure 5-174, and perform the following steps to overhaul the front seat frame and pad group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove front seat frame and pad group as follows:
 - (1) Remove screws attaching passenger seat frame (1) and driver seat frame (2) to front seat tracks.
 - (2) Remove passenger seat frame (1) and driver seat frame (2).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install front seat frame and pad group as follows:
 - (1) Install passenger seat frame (1) and driver seat frame (2) using screws.
 - (2) Tighten screws to torque specified in table 6-2.

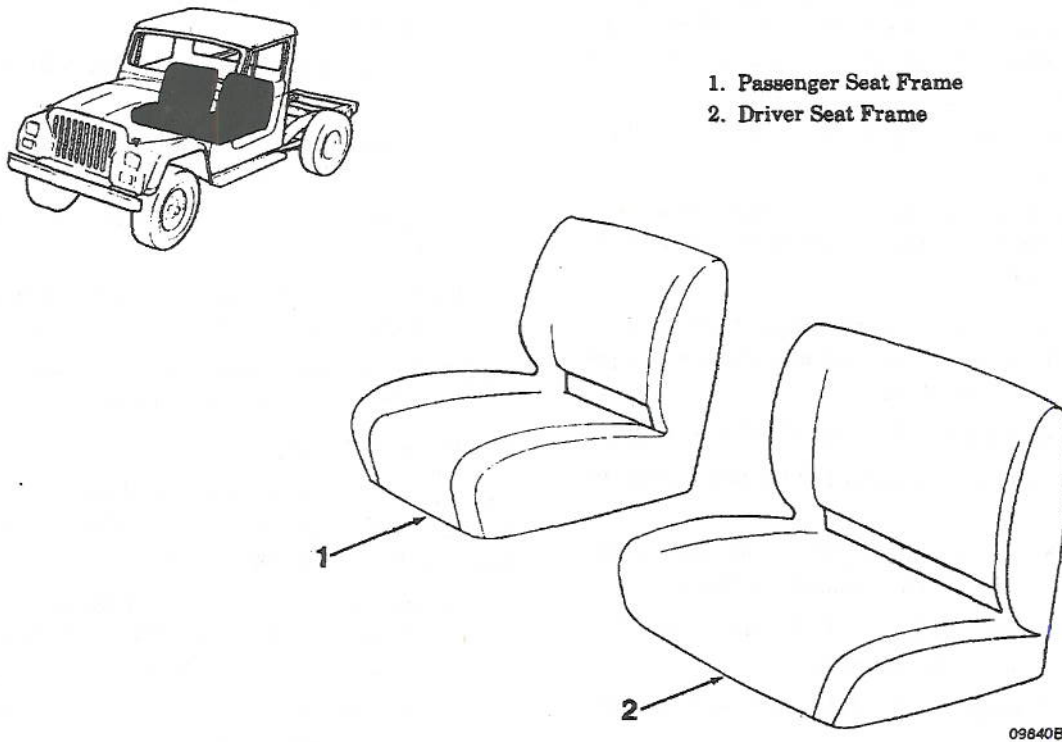


Figure 5-174. Front Seat Frame and Pad Group

5-5.10.2 *Front Seat Track Group*. Refer to figure 5-175, and perform the following steps to overhaul the front seat track group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove front seat track group as follows:

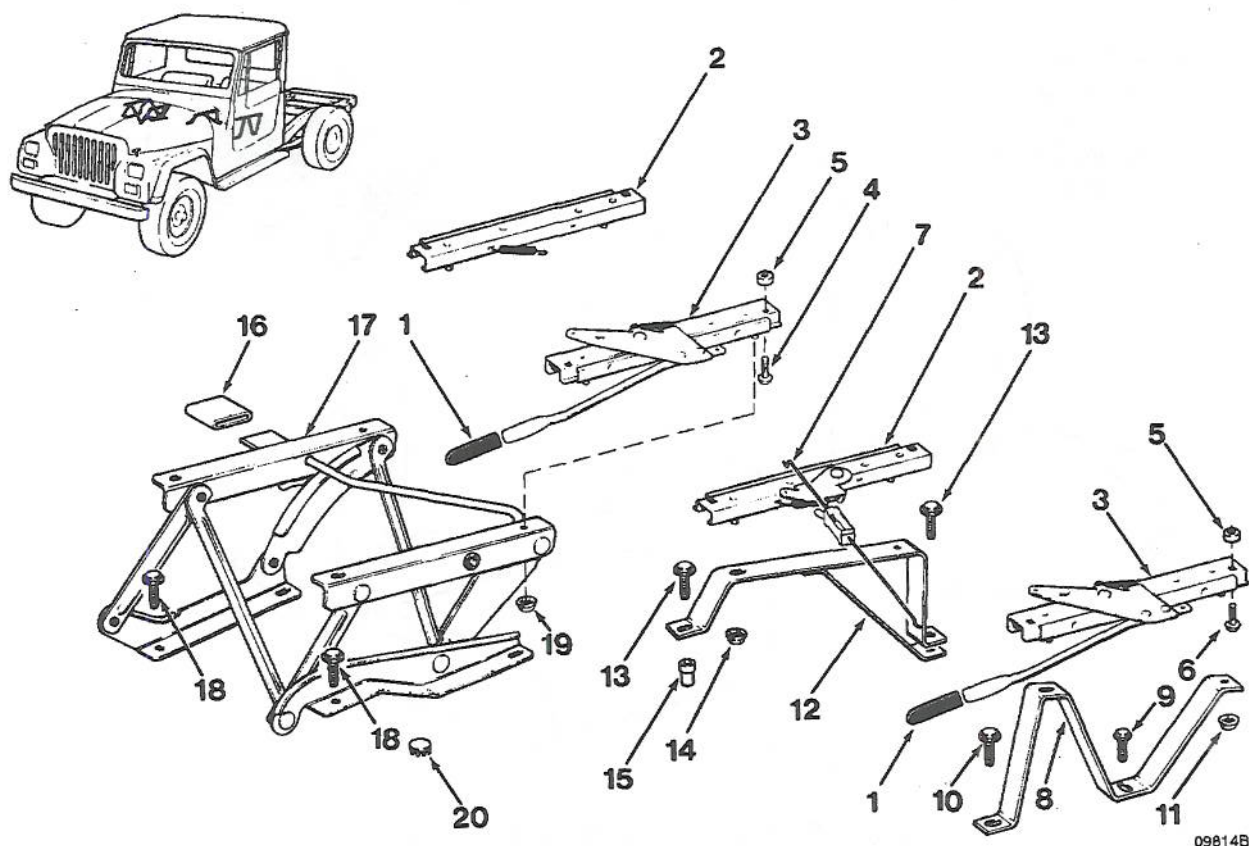
- (1) Remove screws (9), (10), (13) and (18) and remove plug nut (15) securing support assemblies (8) and (12) to floor of vehicle; remove front seat and front seat track group.
- (2) Remove hex nuts (11), (14) and (19); remove seat adjusters (3) and slave seat adjusters (2) from support assemblies (8) and (12).
- (3) Remove machine screws (6) and (4), seat adjusters (3), slave seat adjusters (2) and spacers (5) from seats.
- (4) Remove connector assembly (7).
- (5) Remove support assemblies (8) and (12).
- (6) Remove linkage assembly (17) and seat latch protector (16).
- (7) Remove lever protectors (1).
- (8) Remove plug (20).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install front seat track group as follows:

- (1) Install plug (20).
- (2) Install lever protectors (1).
- (3) Install linkage assembly (17) and seat latch protector (16).
- (4) Install support assemblies (8) and (12).
- (5) Install connector assembly (7).
- (6) Install spacers (5), slave seat adjusters (2) and seat adjusters (3) on seats using machine screws (6) and (4).
- (7) Install slave seat adjusters (3) and seat adjusters (2) on support assemblies (8) and (12) using hex nuts (11), (14) and (19).



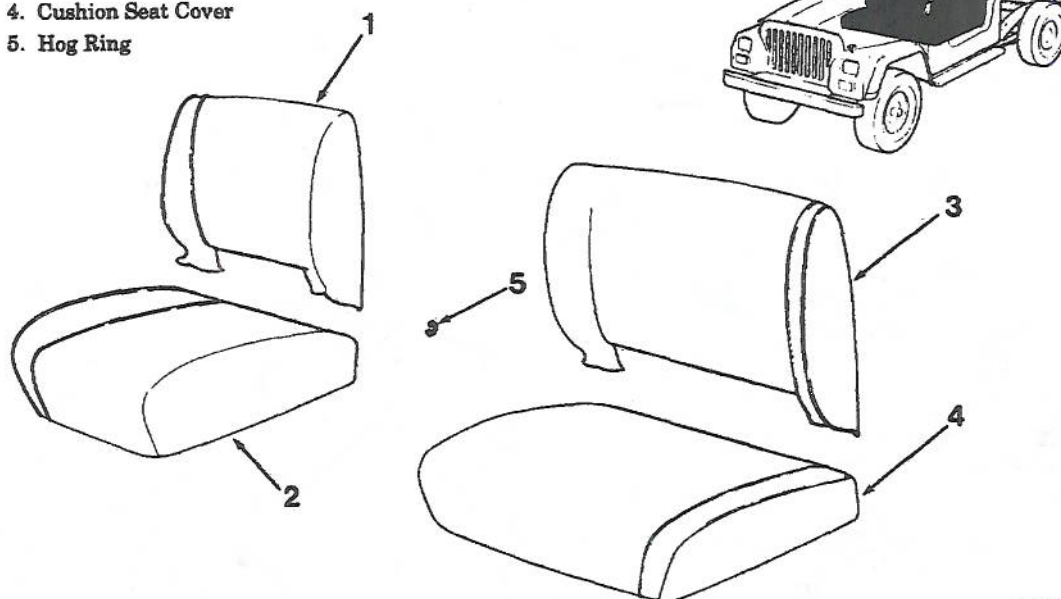
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- | | | |
|------------------------|----------------------|--------------------------|
| 1. Lever Protector | 8. Support Assembly | 15. Plug Nut |
| 2. Slave Seat Adjuster | 9. Screw and Washer | 16. Seat Latch Protector |
| 3. Seat Adjuster | 10. Screw and Washer | 17. Linkage Assembly |
| 4. Machine Screw | 11. Hex Nut | 18. Screw and Washer |
| 5. Spacer | 12. Support Assembly | 19. Hex Nut |
| 6. Machine Screw | 13. Screw and Washer | 20. Plug |
| 7. Connector Assembly | 14. Hex Nut | |

Figure 5-175. Front Seat Track Group

- (8) Secure support assemblies (8) and (12) and plug nut (15) to floor using screws and washers (9), (10), (13) and (18). Tighten screws to torque specified by table 6-2.
- 5-5-10.3 *Front Seat Upholstery Group*. Refer to figure 5-176, and perform the following steps to overhaul the front seat upholstery group.
- Removal and disassembly. Disassembly is accomplished during removal. Remove front seat upholstery group as follows:
 - Remove hog rings (5) from seat cover (1) and seat cover (1).
 - Remove hog rings (5) and cushion seat cover (2).
 - Remove hog rings (5) and seat cover (3).
 - Remove hog rings (5) and cushion seat cover (4).
 - Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
 - Repair and replacement. Replace all worn or damaged parts.

1. Seat Cover
2. Cushion Seat Cover
3. Seat Cover
4. Cushion Seat Cover
5. Hog Ring



09815B

Figure 5-176. Front Seat Upholstery Group

d. Assembly and installation. Assembly is accomplished during installation. Install front seat upholstery group as follows:

- (1) Install cushion seat cover (4) and secure with hog rings (5).
- (2) Install seat cover (3) and secure with hog rings (5).
- (3) Install cushion seat cover (2) and secure with hog rings.
- (4) Install seat cover (1) and secure with hog rings (5).

5-5.10.4 *Seat And Shoulder Belts Group*. Refer to figure 5-177, and perform the following steps to overhaul the seat and shoulder belts group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove seat and shoulder belts group as follows:

- (1) Remove covers (7) and remove pan head bolts (3) using tool #J-25359-C, spacers (4) and washers (5).
- (2) Remove seat and shoulder belts (1) and (12) from side panels.
- (3) Remove bolt covers (8).

(4) Remove pan head bolts (6) and (2) using tool #J-25359-C and remove seat and shoulder belts (1) and (12) from floor.

(5) Remove pan head bolts (2) using tool #J-25359-C and remove belt assemblies (9), (11) and (13).

(6) Remove pan head bolt (6) using tool #J-25359-C and remove belt assembly (10).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

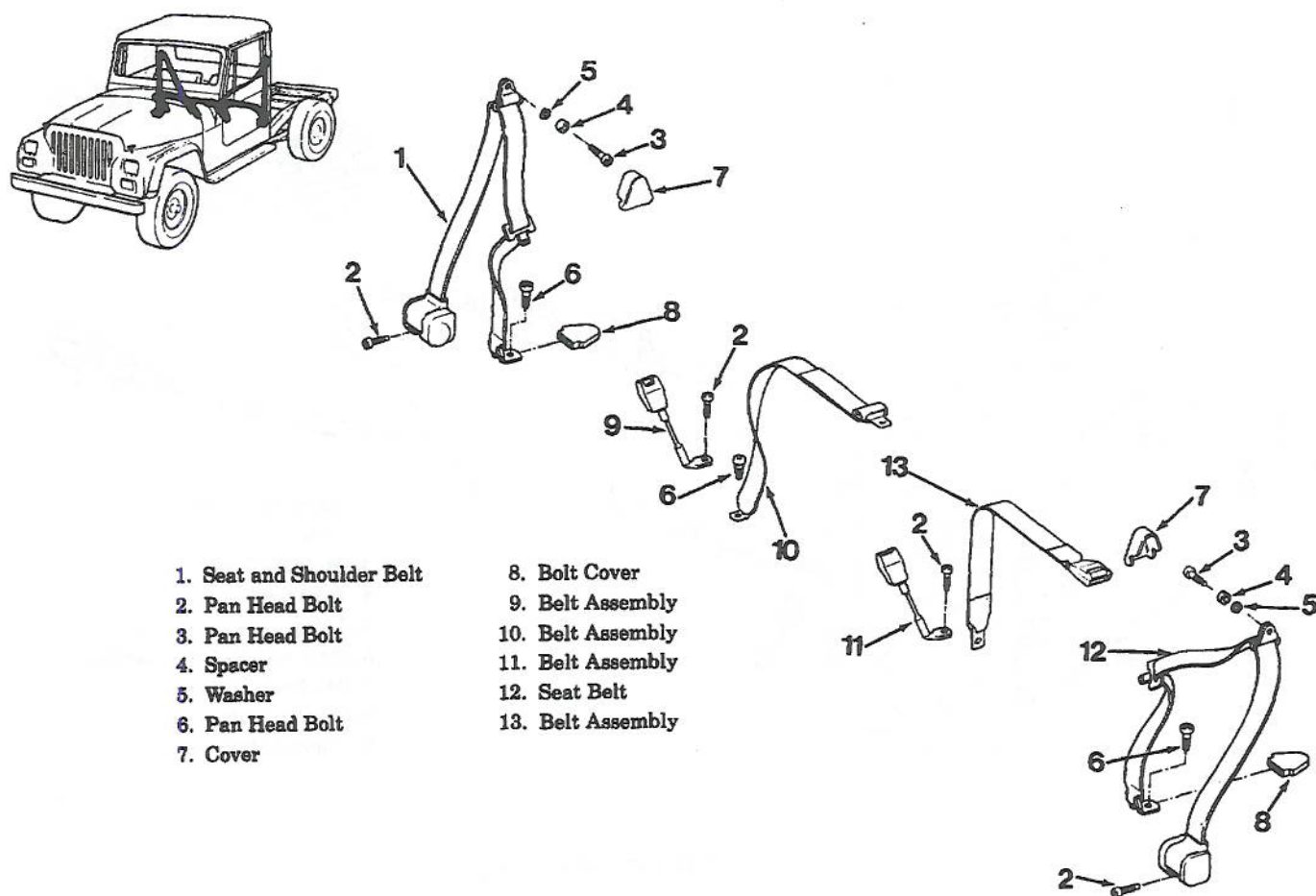
c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install seat and shoulder belts group as follows:

NOTE

Tighten all pan head bolts to torque specified in table 6-2.

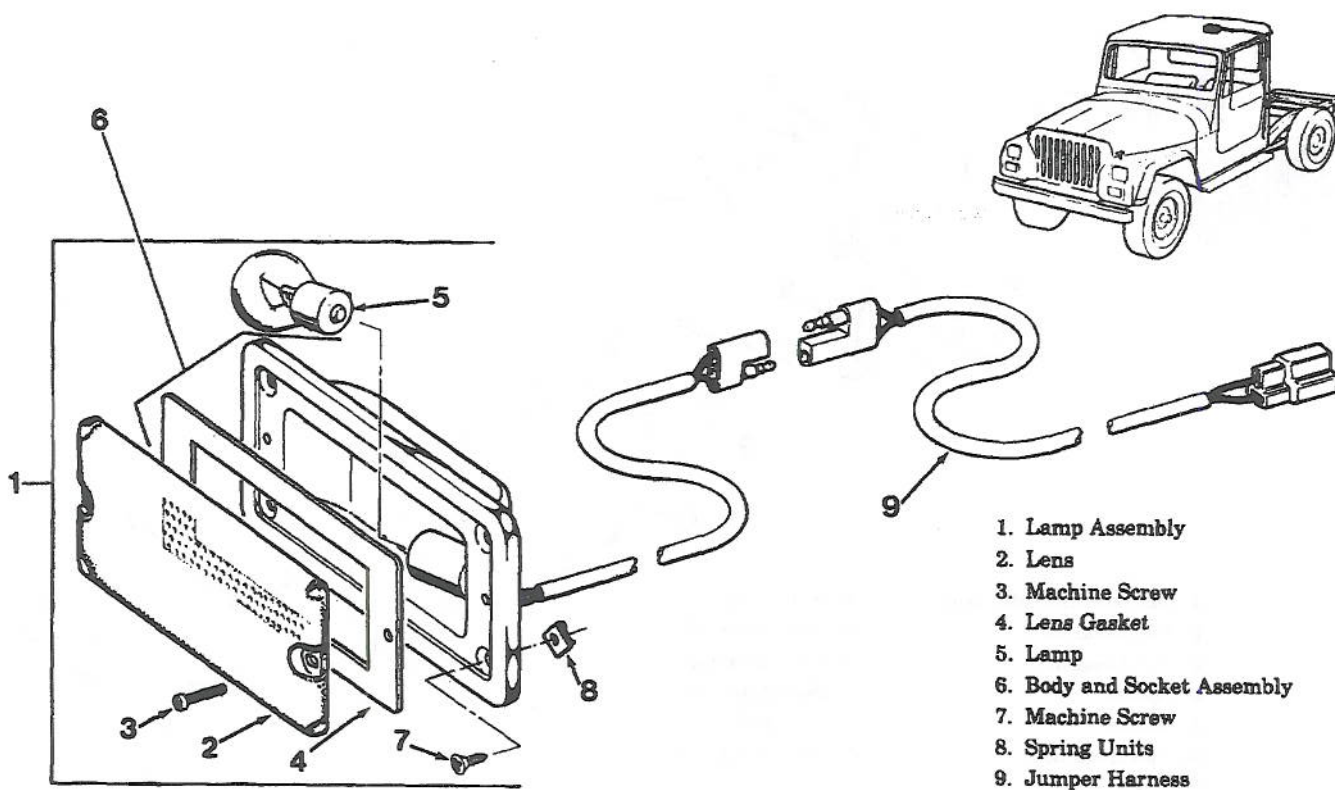
- (1) Install belt assembly (10) using pan head bolt (6). Tighten bolt with tool #J-25359-C.



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Figure 5-177. Seat and Shoulder Belts

- (2) Install belt assemblies (9), (11) and (13) using pan head bolts (2). Tighten bolts with tool #J-25359-C.
 - (3) Install seat and shoulder belts (1) and (12) on floor using pan head bolts (6) and (2). Tighten bolts with tool #J-25359-C.
 - (4) Install bolt covers (8).
 - (5) Install seat and shoulder belts (1) and (12) on side panels using pan head bolts (3), spacers (4) and washers (5). Tighten bolts using tool #J-25359-C.
 - (6) Install covers (7).
- 5-5.10.5 *Dome Lamp Group*. Refer to figure 5-178, and perform the following steps to overhaul the dome lamp group.
- a. Removal and disassembly. Disassembly is accomplished during removal. Remove dome lamp group as follows:
 - (1) Remove machine screws (3) from lamp assembly; remove lens (2) and lens gasket (4).
 - (2) Remove machine screws (7) and pull body and socket assembly (6) away from ceiling.
 - (3) Disconnect jumper harness (9) connectors and remove body and socket assembly (6) and spring units (8).
 - (4) Remove light bulb from body and socket assembly (6).
 - (5) Remove wiring connector on jumper harness (9) and remove jumper harness (9).



09884B

Figure 5-178. Dome Lamp Group

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install dome lamp group as follows:

- (1) Connect wiring connector of jumper harness (9) to vehicle.
- (2) Install light bulb in body and socket assembly (6).
- (3) Connect jumper harness (9) connectors and install body and socket assembly (6) using machine screws (7) and spring units (8).
- (4) Install lens (2) and lens gasket (4) to lamp assembly using machine screws (3).

5-5.10.6 *Headliner And Molding Group*. Refer to figure 5-179, and perform the following steps to overhaul the headliner and molding group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove headliner and molding group as follows:

- (1) Remove fasteners (3) by cutting off heads.
- (2) Support headliner (10) and remove screws (4) and molding (2).
- (3) Remove headliner (1).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install headliner and molding group as follows:

- (1) Position headliner (1) and install fasteners (3).

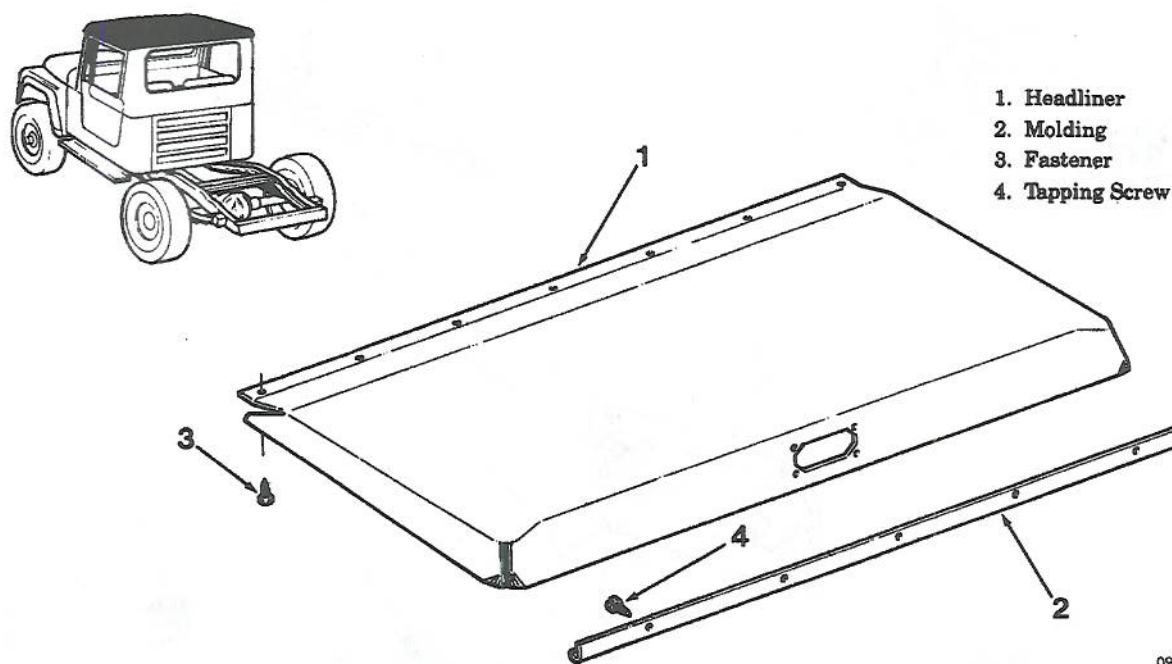


Figure 5-179. Headliner and Molding Group

(2) Install molding (2) and fasteners (3).

(3) Install screws (4).

5-5.10.7 *Window Mechanism Group*. Refer to figure 5-180, and perform the following steps to overhaul the window mechanism group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove window mechanism group components from both doors as follows:

(1) Remove socket head hex screw (8), handle (7) and washer (9).

(2) Remove knob kit (10) from handle (7).

(3) Remove trim panel and watershield.

(4) Lower glass to expose glass channel fasteners. Remove fasteners and guide channel. Raise window to full up position and apply masking tape to glass and over top of window frame.

(5) Remove vent frame lower attaching screw.

(6) Remove regulator screws (3).

(7) Remove washer head hex screw (5) and guide fastener (6).

(8) Push vent frame outward and remove regulator assembly (1) and (2) through access hole in inner door panel.

(9) Remove attaching hardware and remove guide regulator (4).

(10) Remove bumper (11).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

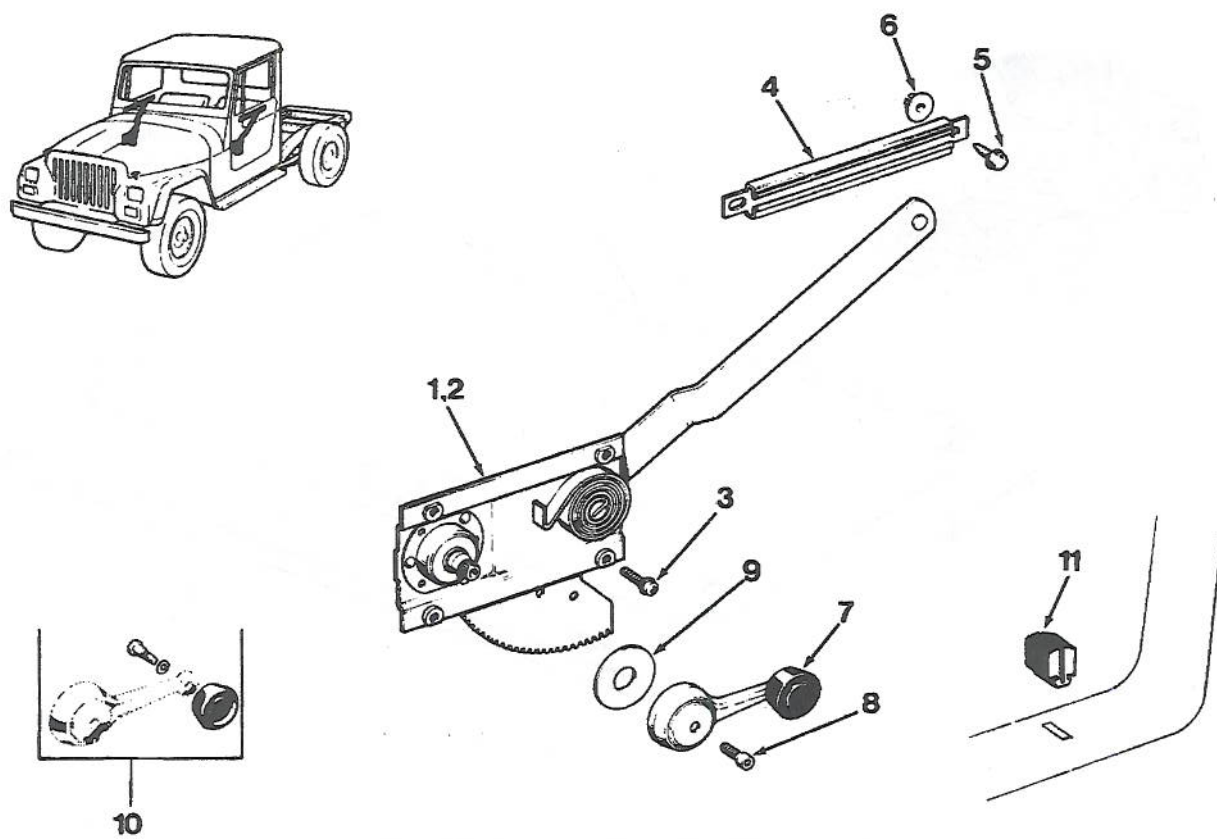
c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install window mechanism group as follows:

(1) Install regulator assemblies (1) and (2) in door using screws (3).

(2) Remove masking tape from glass and lower glass.

(3) Slide guide regulator (4) onto regulator arm and position guide regulator (4) on glass.



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- | | | |
|-----------------------------|---------------------------|--------------|
| 1. Left Regulator Assembly | 5. Washer Head Hex Screw | 9. Washer |
| 2. Right Regulator Assembly | 6. Guide Fastener | 10. Knob Kit |
| 3. Screw | 7. Handle | 11. Bumper |
| 4. Regulator | 8. Socket Head Hex Screws | |

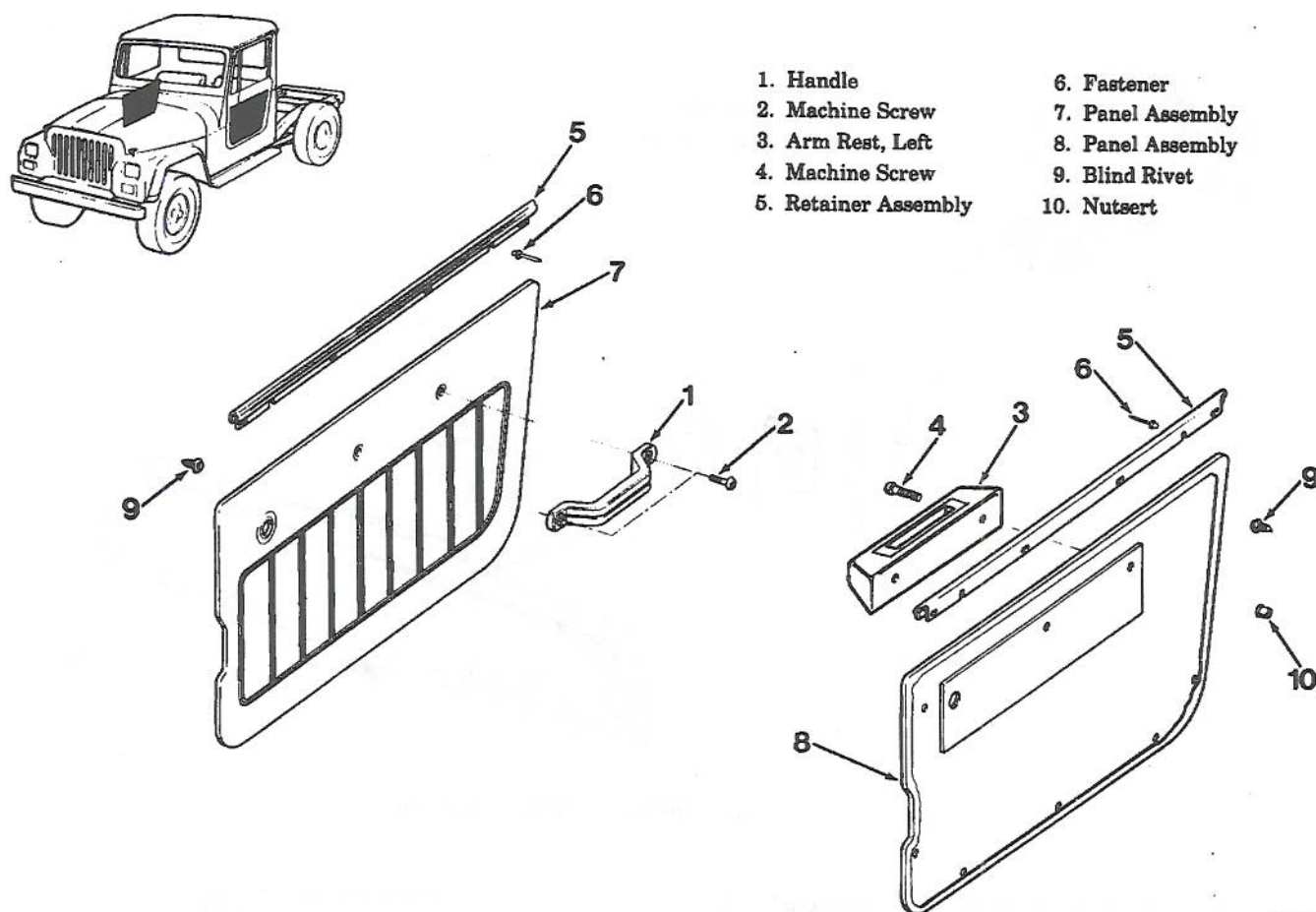
Figure 5-180. Window Mechanism Group

- (4) Install washer head hex screw (5) and guide fastener (6).
- (5) Install bumper (11).
- (6) Install vent frame in door and fasten with attaching hardware.
- (7) Check operation of regulator assembly (1) and (2).
- (8) Install watershield and door trim.
- (9) Install knob kit (10) on handle (7).
- (10) Install handle (7) and washer (9) using socket head screws (8).

5-5.10.8 *Door Trim Panels And Arm Rest Group*. Refer to figure 5-181, and perform the following steps to overhaul the door trim panels and arm rest group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove door trim panels and arm rest group as follows:

- (1) Refer to paragraph 5-5.10.7 and remove window regulator handles.
- (2) Remove screws (2) with torx bit tool #J-25359-C.
- (3) Remove handle (1).



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Figure 5-181. Door Trim Panels and Arm Rest Group

- (4) Remove screws (4) and arm rest (3).
- (5) Remove retainer assemblies (5), blind rivets (9) and nutsert (10).
- (6) Pry fasteners (6) loose and remove panel assemblies (7) right, (8) left.
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install door trim panels and arm rest group as follows:
 - (1) Position panel assemblies (7) right, (8) left on door and install fasteners (6).
 - (2) Install nutsert (10), blind rivets (9) and retainer assemblies (5).
 - (3) Install screws (4) and arm rest (3).
 - (4) Install handle (1) and screws (2) with torx bit tool #J-25359-C.
 - (5) Refer to paragraph 5-5.10.7 and install window regulator handles.

5-5.10.9 *Inside Rear View Mirror Assembly*. Refer to figure 5-182, and perform the following steps to overhaul the inside rear view mirror assembly

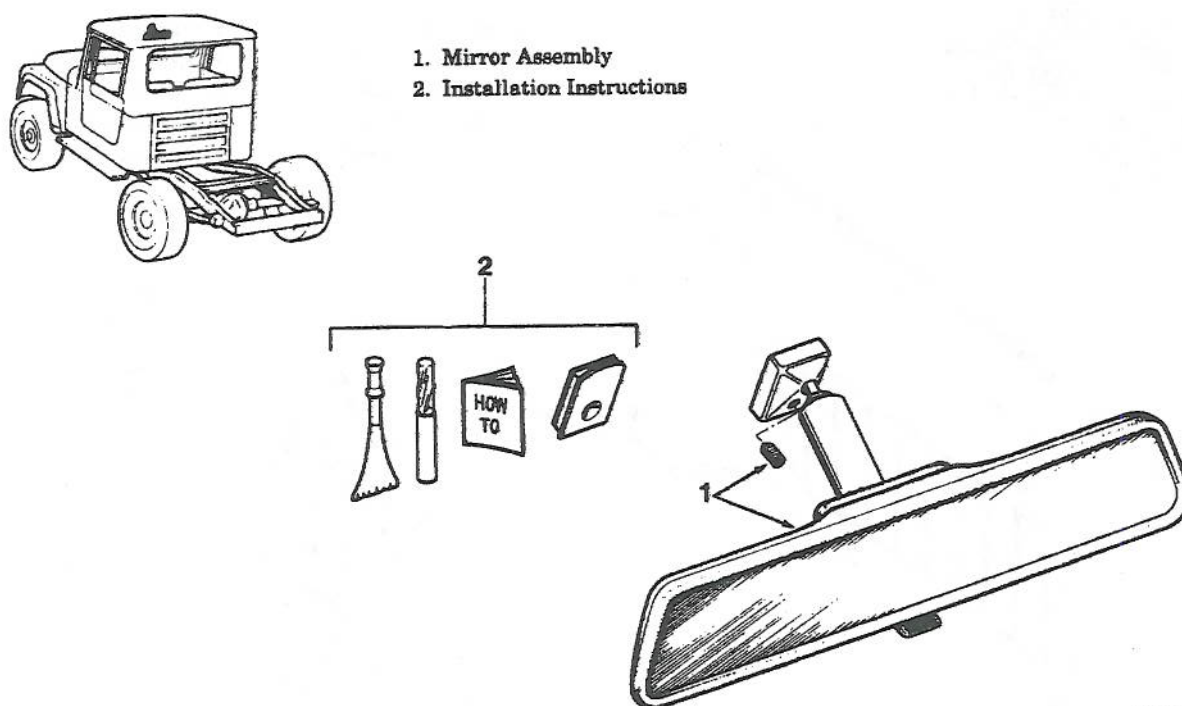
- a. Removal and disassembly. Disassembly is accomplished during removal. Remove inside rear view mirror assembly as follows:

- (1) Remove inside rear view mirror (1) according to instructions in installation instructions (2).

CAUTION

To prevent creasing of the panel assemblies, do not hammer or force the fasteners.

- (1) Position panel assemblies (7) right, (8) left on door and install fasteners (6).



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Figure 5-182. Inside Rear View Mirror Assembly

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install inside rear view mirror assembly as follows:

(1) Use wax pencil on outside of glass to locate mounting bracket (1).

(2) If vinyl pad has remained on windshield glass, apply low heat with an electric heat gun #J-25070 until vinyl softens. Then, peel pad from glass using care not to scratch or mar glass surface.

(3) Clean bracket mounting area of windshield glass thoroughly. Use clean cloth saturated with alcohol.

(4) Scuff bonding surface (the side without the 3/8-inch circular depression) of mirror bracket (1) with clean piece of fine grit sandpaper. Apply alcohol to clean towel and wipe surface clean.

WARNING

Adhesives are flammable and toxic. Avoid prolonged or repeated skin contact. Use only in well-ventilated areas.

(5) Apply generous amount of accelerator (supplied with kit) to mirror bracket (1) mounting surface. Allow 5 minutes to dry.

(6) Apply thin film of accelerator to windshield. Allow 1 minute to dry.

CAUTION

Do not touch surfaces to which accelerator has been applied or an imperfect bond could result.

(7) Apply one drop of adhesive at center of mirror bracket (1) bonding surface. Use bottom of adhesive tube to distribute adhesive evenly over entire surface.

(8) Position bottom straightedge of bracket (1) on horizontal line (figure 5-183). Press bracket (1, figure 5-182) to glass and hold firmly for one minute. Be sure bracket (1) is properly located as adhesive sets quickly.

- (9) Install mirror on bracket. Adjust mirror assembly and tighten using setscrew.

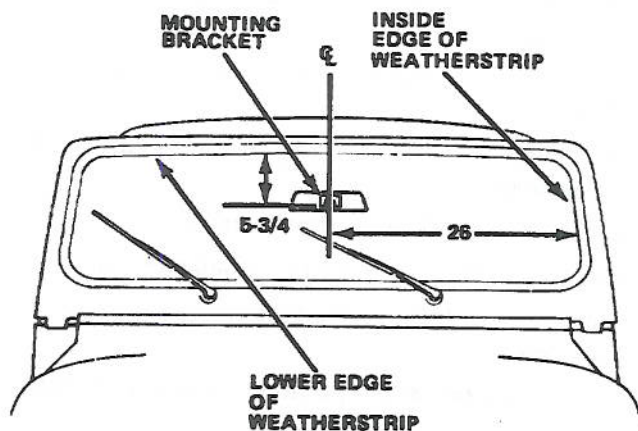
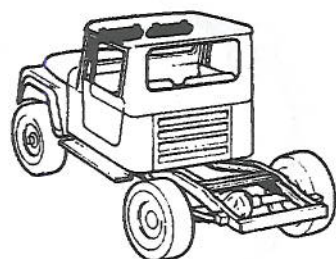


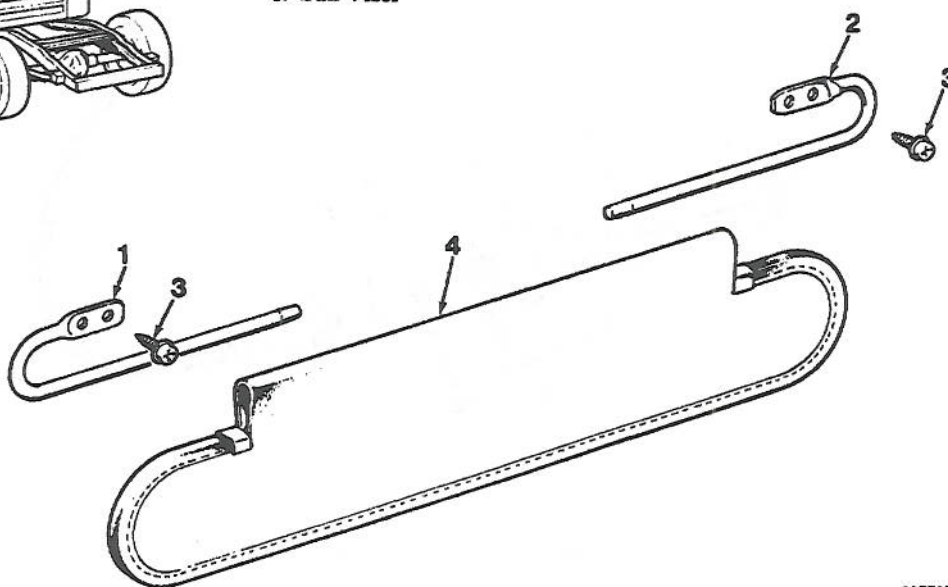
Figure 5-183. Windshield Mounted Rear View Mirror Bracket Location

5-5.10.10 *Sun Visor Group*. Refer to figure 5-184, and perform the following steps to overhaul the sun visor group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove sun visor group as follows:
 - (1) Remove machine screws (3), mounting brackets (1) and (2) and sun visors (4).
 - (2) Remove mounting brackets (1) and (2) from sun visors (4).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install sun visor group as follows:
 - (1) Install mounting brackets (1) and (2) in sun visors (4).
 - (2) Install mounting brackets (1) and (2) on vehicle using machine screws (3).



1. Mounting Bracket
2. Mounting Bracket
3. Machine Screw
4. Sun Visor



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Figure 5-184. Sun Visor Group

5-5.10.11 *Speedometer Cable Group*. Refer to figure 5-185, and perform the following steps to overhaul the speedometer cable group.

a. Removal. Remove speedometer cable group as follows:

- (1) Remove shaft assembly (1) from speedometer.
- (2) Remove machine screw (5) and clamp (4).
- (3) Remove gear (8) from speedometer gear in transfer case.

b. Disassembly. Disassemble speedometer cable group as follows:

- (1) Remove shaft assembly (1) from adapter (6).
- (2) Remove retainer ring (2) and seal (3).
- (3) Remove gear (8) and speedometer ring (7) from adapter (6).

c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

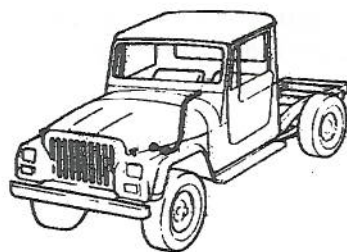
d. Repair and replacement. Replace all worn or damaged parts.

e. Assembly. Assemble speedometer group as follows:

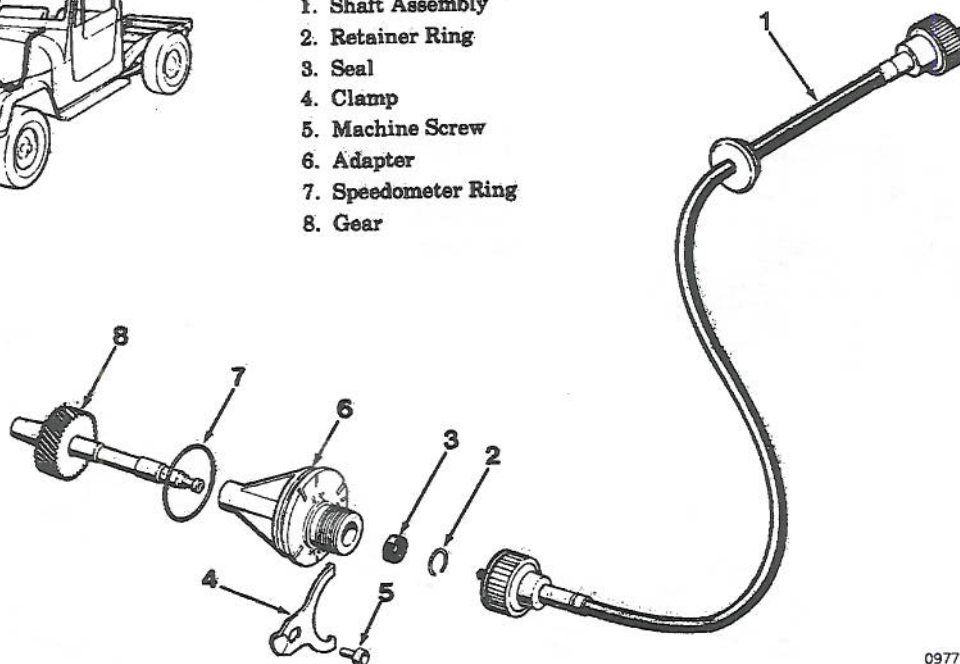
- (1) Install speedometer ring (7) and gear (8) on adapter (6).
- (2) Install seal (3) and retainer ring (2).
- (3) Install shaft assembly (1) on adapter (6).

f. Installation. Install speedometer cable group as follows:

- (1) Install gear (8) in speedometer gear in transfer case.
- (2) Install clamp (4) using machine screw (5).
- (3) Install shaft assembly (1) in speedometer.



1. Shaft Assembly
2. Retainer Ring
3. Seal
4. Clamp
5. Machine Screw
6. Adapter
7. Speedometer Ring
8. Gear



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Figure 5-185. *Speedometer Cable Group*

5-5.10.12 *Heater Hose Group*. Refer to figure 5-186, and perform the following steps to overhaul the heater hose group. If vehicle is equipped with the optional winterization kit, refer to paragraph 5-5.12 for modification of the heater hose group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove the heater hose group as follows:

- (1) Remove tie wrap (1).
- (2) Remove four hose clamps (6), heater hose (4), hot water hose (5) and seal (10).
- (3) Remove screw and washer (3) and two clips (2).
- (4) Remove hose clamp (7), heater drain hose (8) and seal (9).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

c. Repair and replacement. Replace all worn or damaged parts.

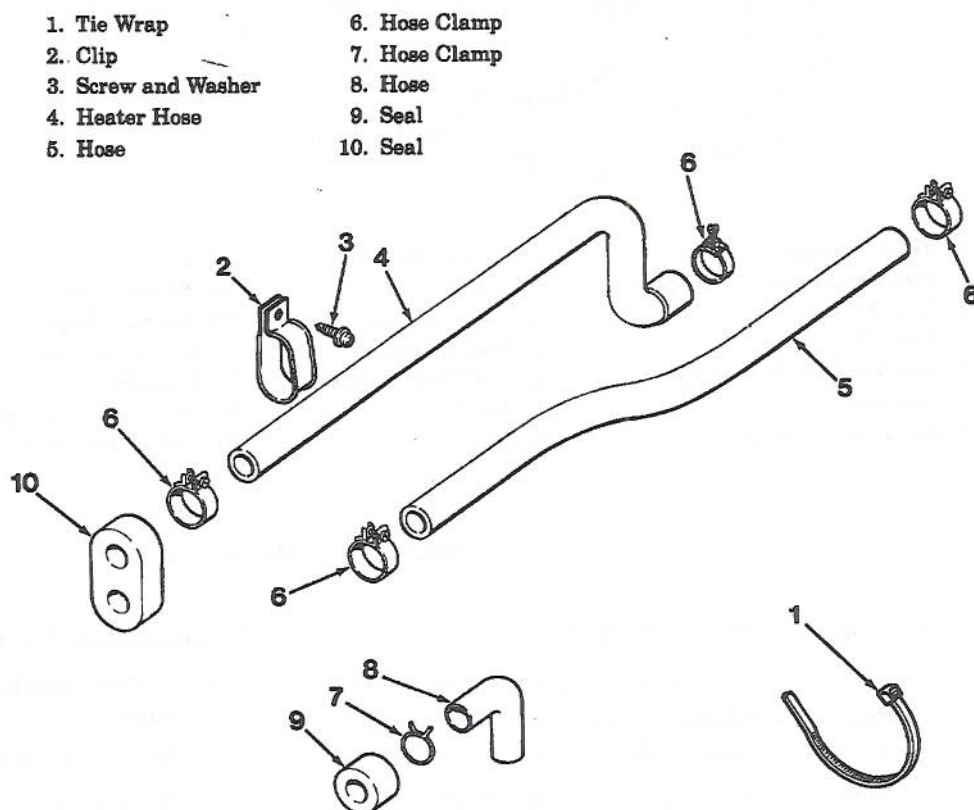
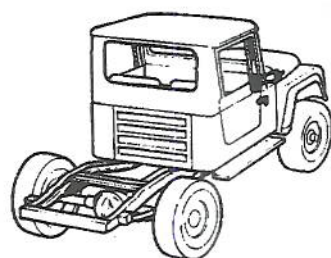
d. Assembly and installation. Assembly of the heater hose group is accomplished during installation. Install the heater hose group as follows:

- (1) Install seal (9), heater drain hose (8) and hose clamp (7).
- (2) Install two clips (2) and screw and washer (3).
- (3) Install seal (10), hot water hose (5), heater hose (4) and four hose clamps (6).
- (4) Install tie wrap (1).

5-5.10.13 *Heater Group*. Refer to figure 5-187, and perform the following steps to overhaul the heater group.

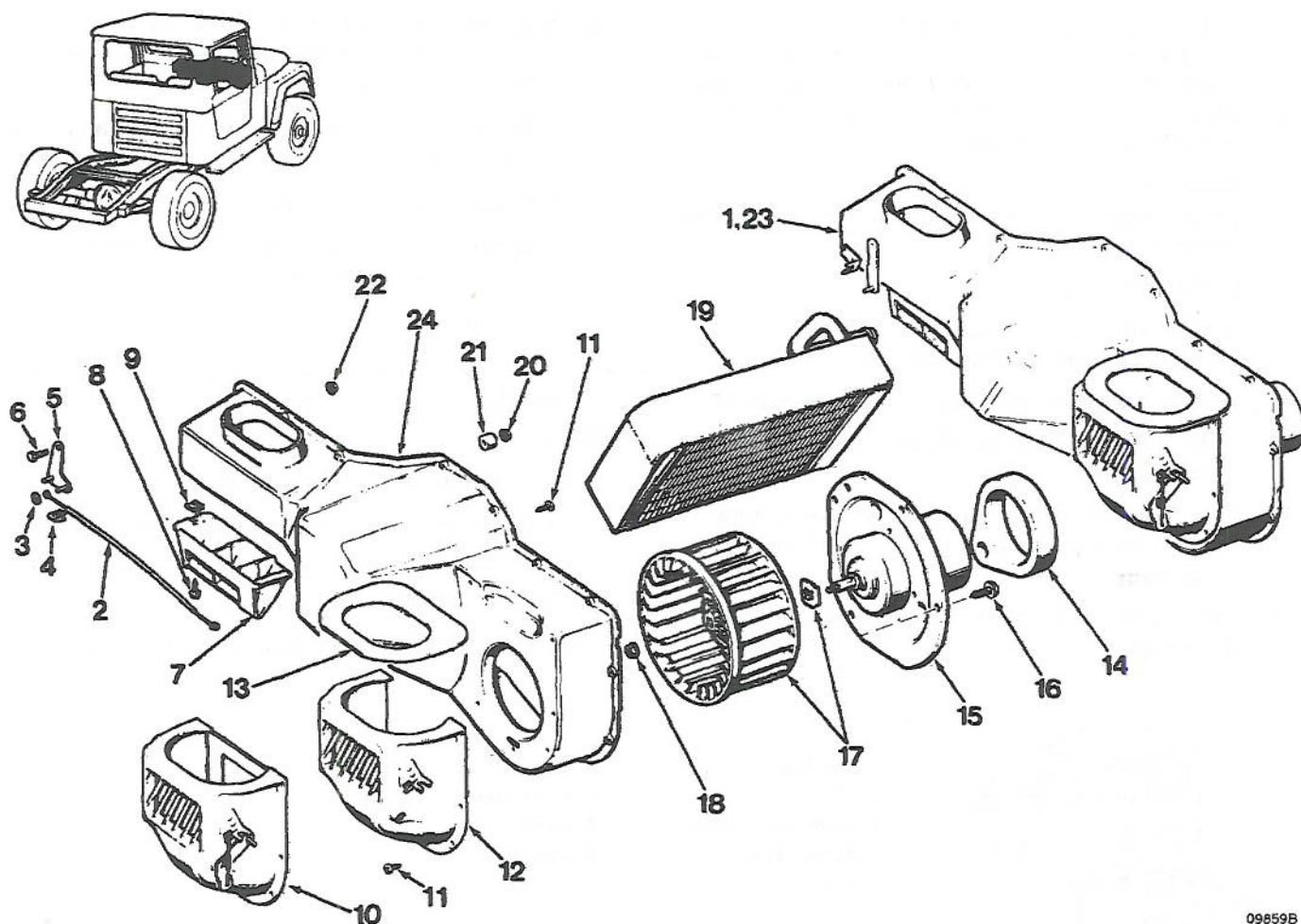
a. Removal. Remove heater group as follows:

- (1) Drain approximately 2 quarts of coolant from radiator.
- (2) Disconnect heater hoses.
- (3) Disconnect damper door control cables.



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Figure 5-186. Heater Hose Group



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- | | | | |
|---------------------------------|--|--------------------------|--|
| 1. Heater Assembly | 8. Machine Screw | 14. Seal | 21. Spacer |
| 2. Temperature Control Assembly | 9. U-Nut | 15. Blower Motor | 22. Nut and Washer |
| 3. Push-On Nut | 10. Inlet Case Assembly | 16. Machine Screw | 23. Heater Motor
(less core, fan motor) |
| 4. Speed Clip | 11. Machine Screw | 17. Blower Fan w/nut | 24. Heater Case |
| 5. Link and Pivot Pin Assembly | 12. Inlet Case Assembly
(less damper) | 18. Plain Nut | |
| 6. Capcrew | 13. Seal | 19. Heater Core Assembly | |
| 7. Heater Outlet Adapter | | 20. Self-Locking Nut | |

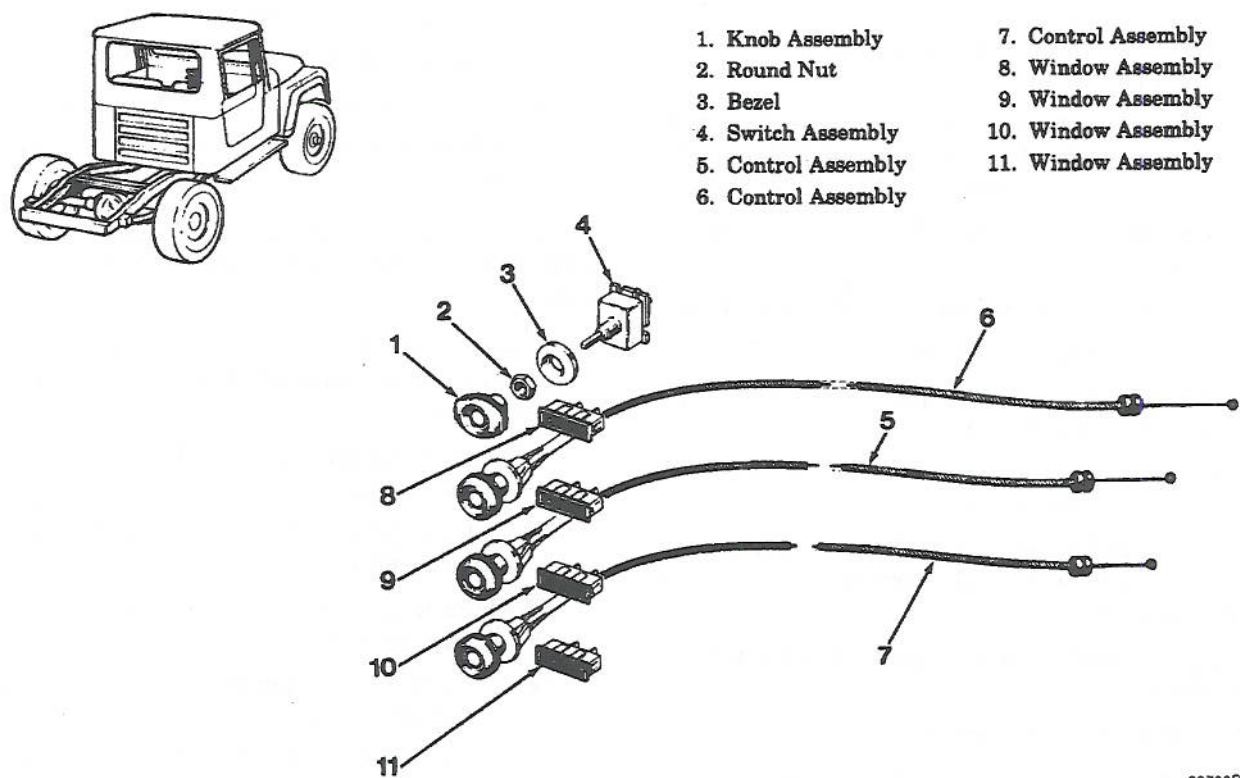
Figure 5-187. Heater Group

- (4) Disconnect blower motor wire.
- (5) Disconnect water drain hose and defroster hose.
- (6) Remove self-locking nuts (20) and spacers (21) from heater case studs.
- (7) Remove heater assembly (1) by tilting down to disengage from air inlet duct and pulling to rear of vehicle.

b. Disassembly. Disassemble heater group as follows:

- (1) Remove machine screws (11) from heater assembly (1).
- (2) Remove back of heater assembly (1).
- (3) Remove heater core assembly (19).
- (4) Remove nut (18) and blower fan and nut (17).

- (5) Remove machine screws (16) and blower motor (15).
 - (6) Remove blower motor seal (14) from blower motor (15).
 - (7) Remove machine screws (11) connecting inlet case assembly (10) to heater case (24) and remove inlet case assembly (10).
 - (8) Remove air duct seal (13) from inlet case assembly (10).
 - (9) Remove nut and washer (22) and capscrew (6).
 - (10) Remove link and pivot pin assembly (5).
 - (11) Remove speed clip (4), push nut (3) and temperature control assembly (2).
 - (12) Remove machine screw (8), spring U-nut (9) and heater outlet adapter (7).
 - c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
 - d. Repair and replacement. Replace all worn or damaged parts.
 - e. Assembly. Assemble heater as follows:
 - (1) Install heater outlet adapter (7) using machine screw (8) and spring U-nut (9).
 - (2) Install temperature control assembly (2) using push nut (3).
 - (3) Install speed clip (4).
 - (4) Install link and pivot pin assembly (5) using capscrew (6) and nut and washer (22).
 - (5) Install air duct seal (13) and damper from inlet case assembly (10).
 - (6) Install inlet case assembly (10) or (12) on heater case (24) using machine screws (11).
 - (7) Install blower motor seal (14) and install blower motor (15) using machine screws (16).
 - (8) Insert stem of blower motor (15) through back of heater assembly (1).
 - (9) Install blower fan and nut (17) and nut (18).
 - (10) Install heater core assembly (19).
 - (11) Install back of heater assembly (1) using machine screws (11).
 - f. Installation. Install heater as follows:
 - (1) Install heater assembly in vehicle using selflocking nuts (20) and spacers (21).
 - (2) Connect water drain hose and defroster hose.
 - (3) Connect blower motor wire.
 - (4) Connect damper door control cables.
 - (5) Connect heater hoses.
 - (6) Add approximately 2 quarts of coolant to radiator.
- 5-5.10.14 *Heater Controls*. Refer to figure 5-188, and perform the following steps to overhaul the heater controls.
- a. Removal and disassembly. Disassembly is accomplished during removal. Remove heater controls as follows:
 - (1) Refer to paragraph 5-5.10.13 and remove control assembly (6).
 - (2) Refer to paragraph 5-5.10.15 and remove control assembly (7).
 - (3) Refer to paragraph 5-5.10.16 and remove control assembly (5).
 - (4) Remove knob assembly (1), nut (2), bezel (3) and switch assembly (4).
 - (5) Refer to paragraph 5-5.10.18 and remove control assemblies (5), (6) and (7).
 - (6) Remove window assemblies (8), (9), (10) and (11).
 - b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
 - c. Repair and replacement. Replace all worn or damaged parts.
 - d. Assembly and installation. Assembly is accomplished during installation. Install heater controls as follows:
 - (1) Install window assemblies (8), (9), (10) and (11).
 - (2) Refer to paragraph 5-5.10.18 and install control assemblies (5), (6) and (7).
 - (3) Install knob assembly (1), nut (2), bezel (3) and switch assembly (4).
 - (4) Refer to paragraph 5-5.10.16 and install control assembly (5).
 - (5) Refer to paragraph 5-5.10.13 and install control assembly (6).
 - (6) Refer to paragraph 5-5.10.15 and install control assembly (7).



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Figure 5-188. Heater Controls

5-5.10.15 *Defroster Duct Group*. Refer to figure 5-189, and perform the following steps to overhaul the defroster duct group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove defroster duct as follows:

- (1) Remove machine screws (2) and (4) and remove left air deflector (1) and right air deflector (3).
- (2) Disconnect negative battery cable.
- (3) Drain 2 quarts of coolant from radiator.
- (4) Refer to paragraph 5-5.10.12 and remove heater hoses.
- (5) Remove drain tube from heater housing.
- (6) Remove screw attaching heater motor housing to bracket.
- (7) Remove nuts attaching heater housing to dash panel from engine compartment.
- (8) Disconnect speedometer cable.
- (9) Remove glove box.

(10) Tilt heater housing assembly back. Pull to rear and lower housing.

(11) Disconnect heater control cables.

(12) Remove fresh air cover panel from cowl.

(13) Remove fresh air intake duct assembly.

(14) Lower windshield.

(15) Remove machine screws (7).

(16) Remove defroster nozzle (6) and hose (5).

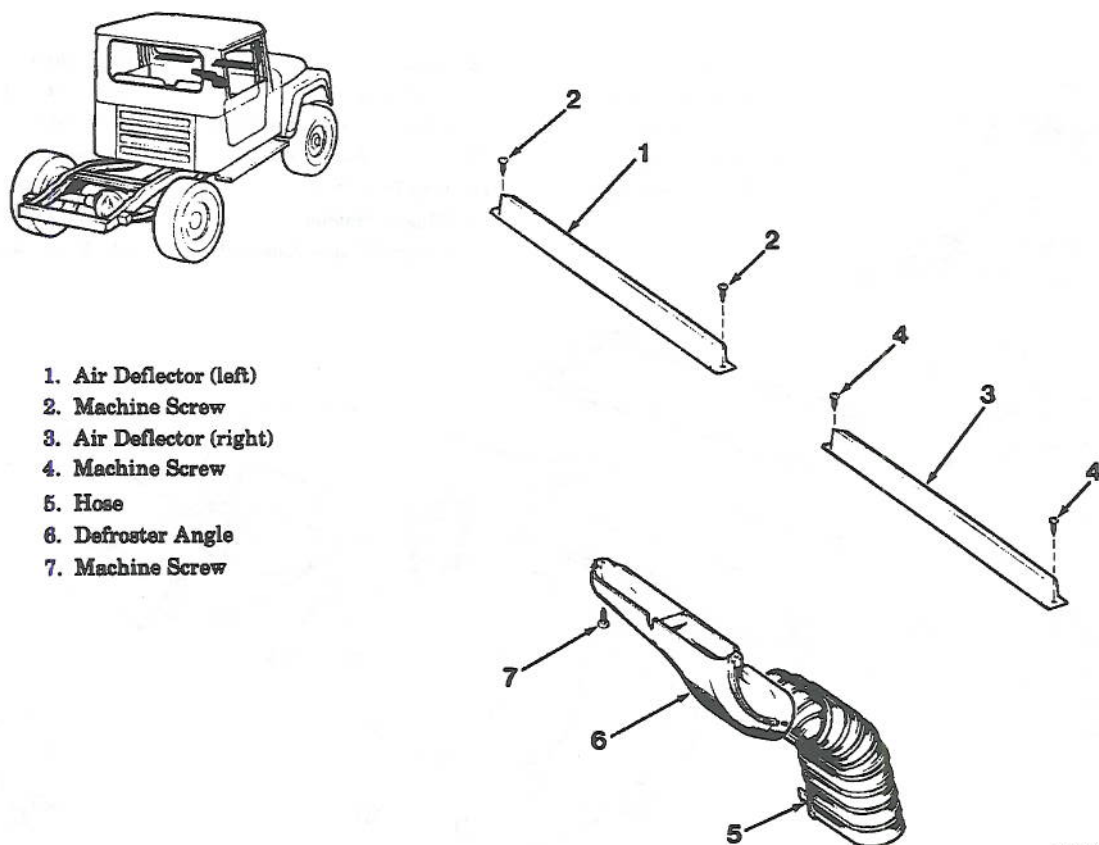
(17) Separate defroster nozzle (6) and hose (5).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install defroster duct group as follows:

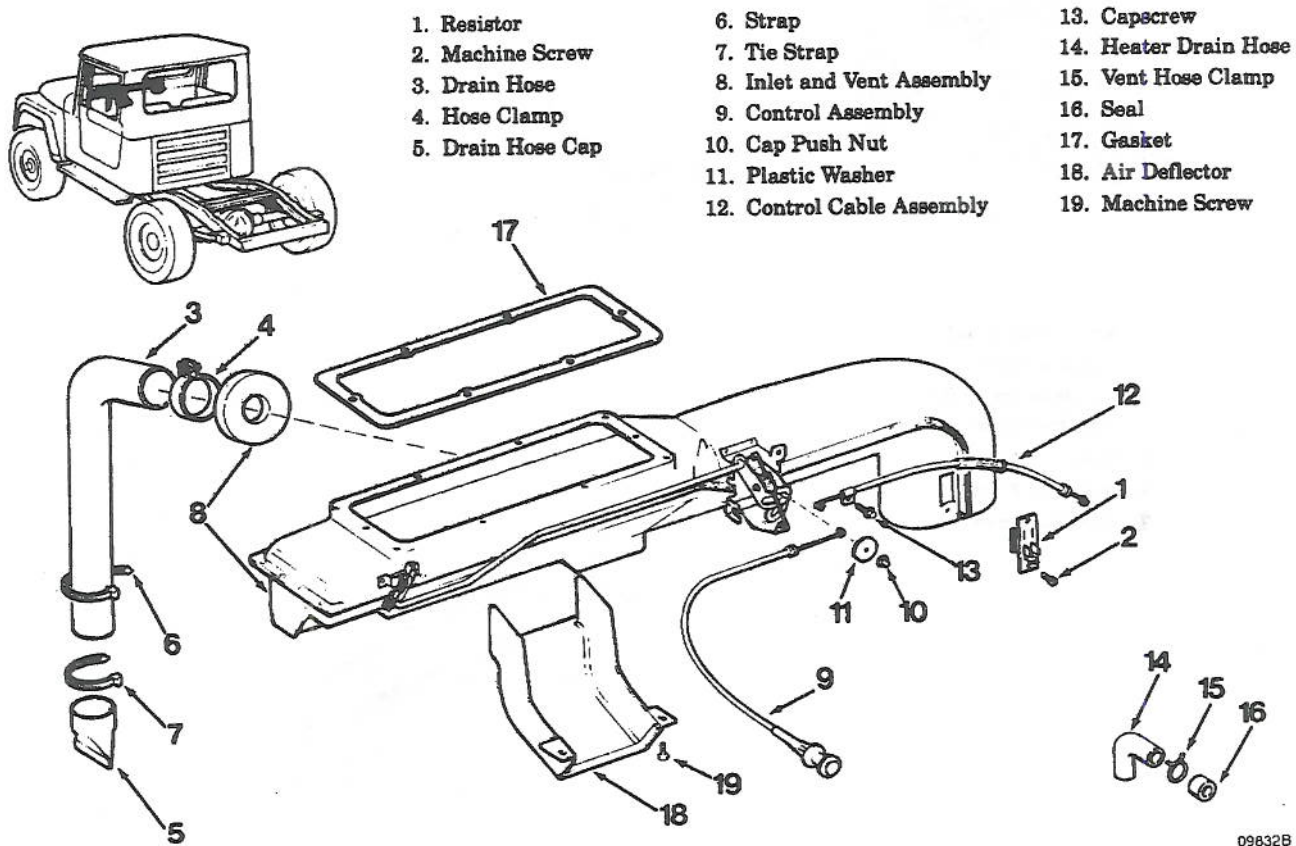
- (1) Connect defroster nozzle (6) and hose (5).



09780B

Figure 5-189. Defroster Duct Group

- (2) Position defroster nozzle (6) and hose (5) and install using machine screws (7).
 - (3) Raise windshield and secure.
 - (4) Install fresh air intake duct assembly.
 - (5) Install fresh air cover panel from cowl.
 - (6) Connect heater control cables.
 - (7) Position heater housing assembly.
 - (8) Install glove box.
 - (9) Connect speedometer cable.
 - (10) Install nuts attaching heater housing to dash panel to engine compartment.
 - (11) Install screw attaching heater motor housing to bracket.
 - (12) Install drain tube on heater housing.
 - (13) Refer to paragraph 5-5.10.12 and install heater hoses.
 - (14) Add 2 quarts of coolant to radiator.
 - (15) Connect battery negative cable.
 - (16) Install left and right air deflector (1) and (3) using screws (2) and (4).
- 5-5.10.16 *Fresh Air Intake Group*. Refer to figure 5-190, and perform the following steps to overhaul the fresh air intake group.
- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the fresh air intake group as follows:
 - (1) Disconnect negative battery cable.
 - (2) Drain 2 quarts of antifreeze from radiator.
 - (3) Remove heater hoses.
 - (4) Remove heater drain hose (14); remove vent hose clamp (15) and seal (16) from heater drain hose (14).
 - (5) Remove screw attaching heater motor housing to bracket.

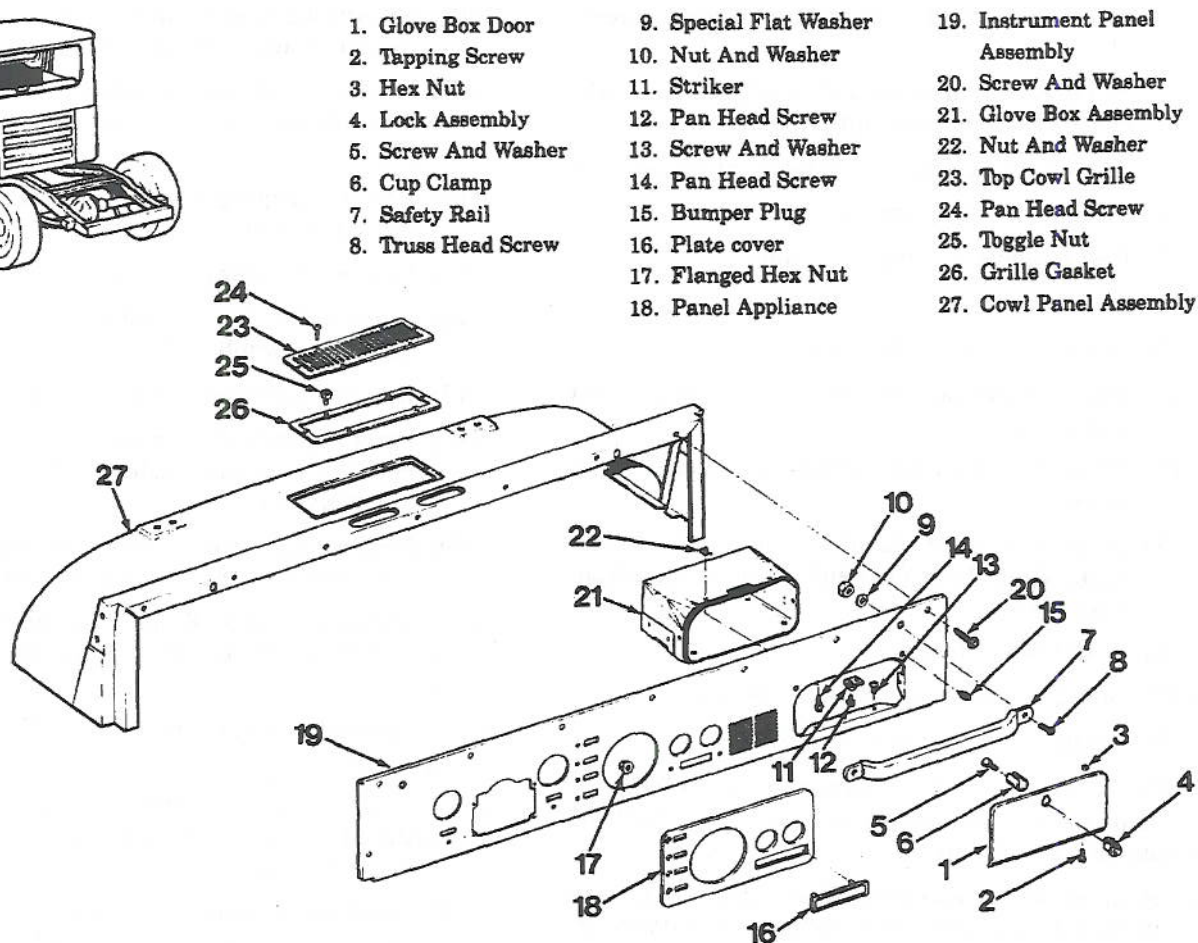
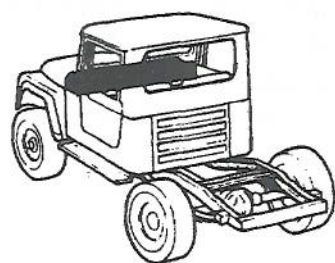


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Figure 5-190. Fresh Air Intake Group

- (6) Remove nuts attaching heater housing to dash panel from engine compartment.
 - (7) Disconnect speedometer cable.
 - (8) Remove glovebox.
 - (9) Tilt heater housing assembly back. Pull to rear and lower housing.
 - (10) Disconnect heater control cables.
 - (11) Remove capscrew (13) and control cable assembly (12).
 - (12) Remove push nut (10), plastic washer (11) and control assembly (9).
 - (13) Remove machine screws (19) and air deflector (18).
 - (14) Loosen hose clamp (4) and remove drain hose (3).
 - (15) Remove strap (6), tie strap (7) and drain hose cap (5).
 - (16) Remove machine screw (2) and resistor (1).
 - (17) Remove inlet and vent assembly (8).
 - (18) Remove gasket (17).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install fresh air intake group as follows:
- (1) Install gasket (17) on inlet and vent assembly (8).
 - (2) Install inlet and vent assembly (8).
 - (3) Install resistor (1) using machine screw (2).
 - (4) Install drain hose cap (5) on drain hose (3) using strap (6) and tie strap (7).
 - (5) Install drain hose (3) using hose clamp (4).

- (6) Install air deflector (18) using machine screws (19).
 - (7) Install control assembly (9) using plastic washer (11) and cap push nut (10).
 - (8) Install cable assembly (12) using capscrew (13).
 - (9) Connect heater control cables.
 - (10) Position heater housing assembly.
 - (11) Install glovebox.
 - (12) Connect speedometer cable.
 - (13) Install heater housing assembly to dash panel using nuts.
 - (14) Install heater motor housing to bracket using screw.
 - (15) Install vent hose clamp (15) and seal (16) on heater drain hose (14) and install heater drain hose (14).
 - (16) Install heater hoses.
 - (17) Add 2 quarts of antifreeze to radiator.
 - (18) Connect negative battery cable.
- 5-5.10.17 *Instrument Panel Group*. Refer to figure 5-191, and perform the following steps to overhaul the instrument panel group.
- a. Removal and disassembly. Disassembly is accomplished during removal. Remove instrument panel group as follows:
 - (1) Disconnect battery negative cable.
 - (2) Remove steering column bezel.
 - (3) Disconnect speedometer cable.
 - (4) Disconnect heater cables from damper door levers.
 - (5) Remove windshield clamp knobs and brackets.
 - (6) Refer to paragraph 5-5.9.13 and remove hard-top enclosure.
 - (7) Fold windshield down onto hood.
 - (8) Disconnect all electrical connections.
 - (9) Refer to paragraph 5-5.4.1 and remove steering wheel.
 - (10) Remove screws and washers (20) and remove instrument panel assembly (19) from cowl panel assembly (27).
 - (11) Remove panel applique (18) and remove plate cover (16).
 - (12) Remove flanged hex nut (17); refer to paragraph 5-5.10.19 and remove instrument cluster.
 - (13) Remove truss head screws (8), nuts and washers (10), special flat washers (9) and safety rail (7).
 - (14) Remove tapping screws (2), hex nuts (3) and glove box door (1).
 - (15) Remove bumper plugs (15).
 - (16) Remove screw and washer (5), cup clamp (6) and lock assembly (4).
 - (17) Remove pan head screws (12) and striker (11).
 - (18) Remove pan head screws (14), screws and washers (13), nuts and washers (22) and glove box assembly (21).
 - (19) Remove pan head screws (24), top cowl grille (23), toggle nut (25) and grille gasket (26).
 - b. Cleaning inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
 - c. Repair and replacement. Replace all worn or damaged parts.
 - d. Assembly and installation. Assembly is accomplished during installation. Install instrument panel group as follows:
 - (1) Install grille gasket (26), toggle nut (25) and top cowl grille (23) using pan head screws (24) in cowl panel assembly (27).
 - (2) Install glove box assembly (21) using pan head screws (14), screws and washers (13) and nuts and washers (22).
 - (3) Install striker (11) using pan head screws (12).
 - (4) Install lock assembly (4) and cup clamp (6) using screw and washer (5).
 - (5) Install bumper plugs (15).
 - (6) Install glove box door (1) using tapping screws (2) and hex nuts (3).
 - (7) Install safety rail (7) using truss head screws (8), special flat washers (9) and nuts and washers (10).
 - (8) Refer to paragraph 5-5.10.19 and install instrument cluster using flanged hex nut (17).
 - (9) Install plate cover (16) in panel applique (18) and install panel applique (18) in instrument panel (19).



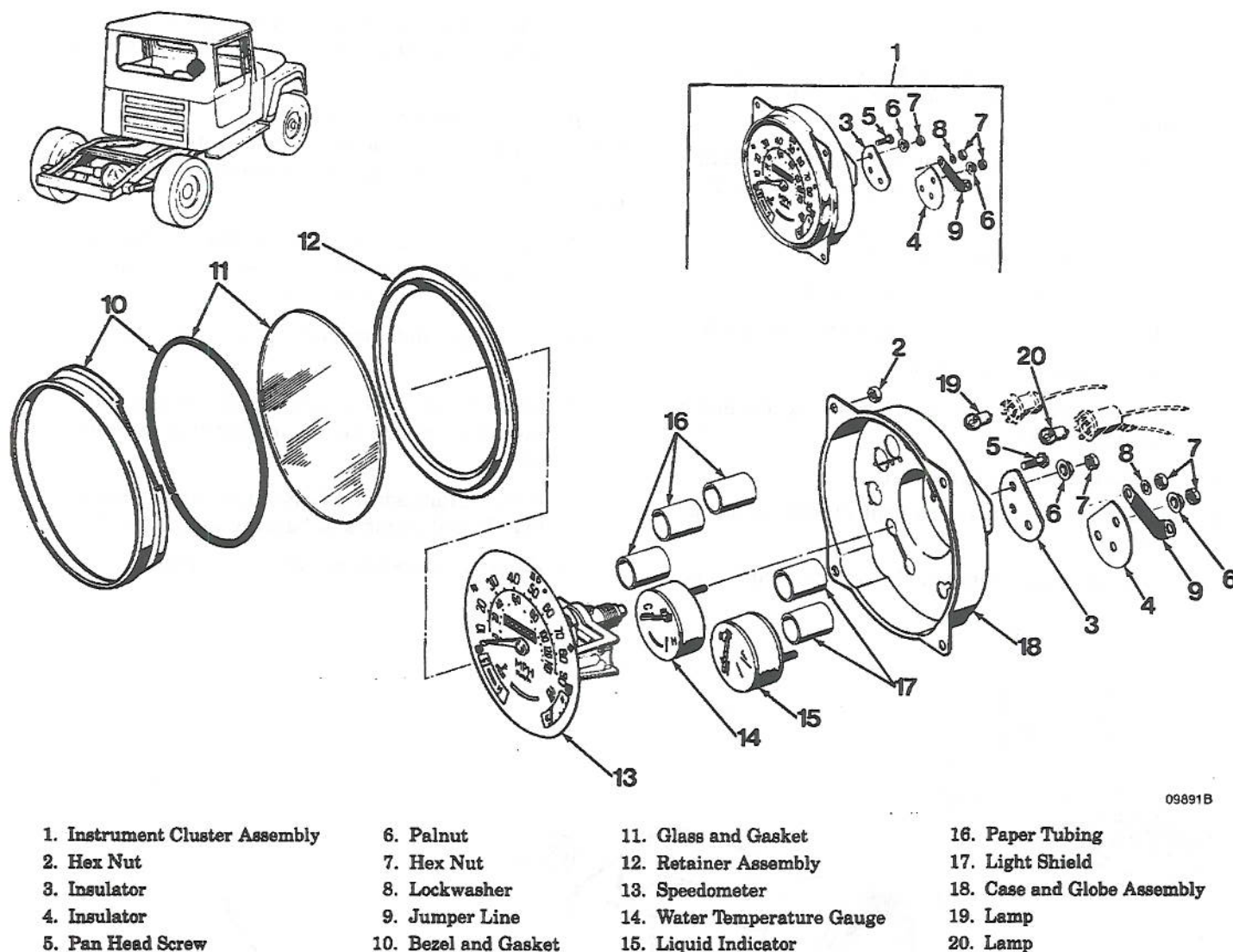
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Figure 5-191. Instrument Panel Group

- (10) Install instrument panel assembly (19) in cowl panel assembly (27) using screws and washers (20).
- (11) Refer to paragraph 5-5.4.1 and install steering wheel.
- (12) Connect all electrical connections.
- (13) Raise windshield to upright position.
- (14) Refer to paragraph 5-5.9.13 and install hardtop enclosure.
- (15) Install windshield brackets and clamp knobs.
- (16) Connect heater control knobs to damper door levers.
- (17) Connect speedometer cable.
- (18) Install steering column bezel on instrument panel and install attaching screws.
- (19) Connect battery negative cable.

5-5.10.18 *Instrument Cluster Group.* Refer to figure 5-192, and perform the following steps to overhaul the instrument cluster group.

- a. Removal. Remove instrument cluster group as follows:
 - (1) Disconnect battery negative cable.
 - (2) Disconnect speedometer cable.
 - (3) Remove attaching screws and hex nuts (2) and instrument cluster assembly (1).
 - (4) Mark bulb and wire connectors and disconnect cluster electrical connectors and lamps.
- b. Disassembly. Disassemble instrument cluster group as follows:
 - (1) Remove bezel and gasket (10) from case and globe assembly (18).
 - (2) Remove glass and gasket (11) from case and globe assembly (18).



09891B

Figure 5-192. Instrument Cluster Group

- (3) Remove retainer assembly (12).
 - (4) Remove speedometer (13) and paper tubing (16).
 - (5) Remove pan head screws (5).
 - (6) Remove hex nuts (7), palnuts (6), jumper link (9) and insulators (3) and (4).
 - (7) Remove water temperature gauge (14), liquid indicator (15) and light shields (17).
 - (8) Remove lamps (19) and (20).
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- d. Repair and replacement. Replace all worn or damaged parts.
 - e. Assembly. Assemble instrument cluster group as follows:
 - (1) Install lamps (19) and (20).
 - (2) Install water temperature gauge (14), liquid indicator (15) and light shields (17).
 - (3) Install insulators (3) and (4), jumper link (9), palnuts (6) and hex nuts (7).
 - (4) Install pan head screws (5).

NOTE

If reinstalling old speedometer, the following odometer setting procedures need not be performed.

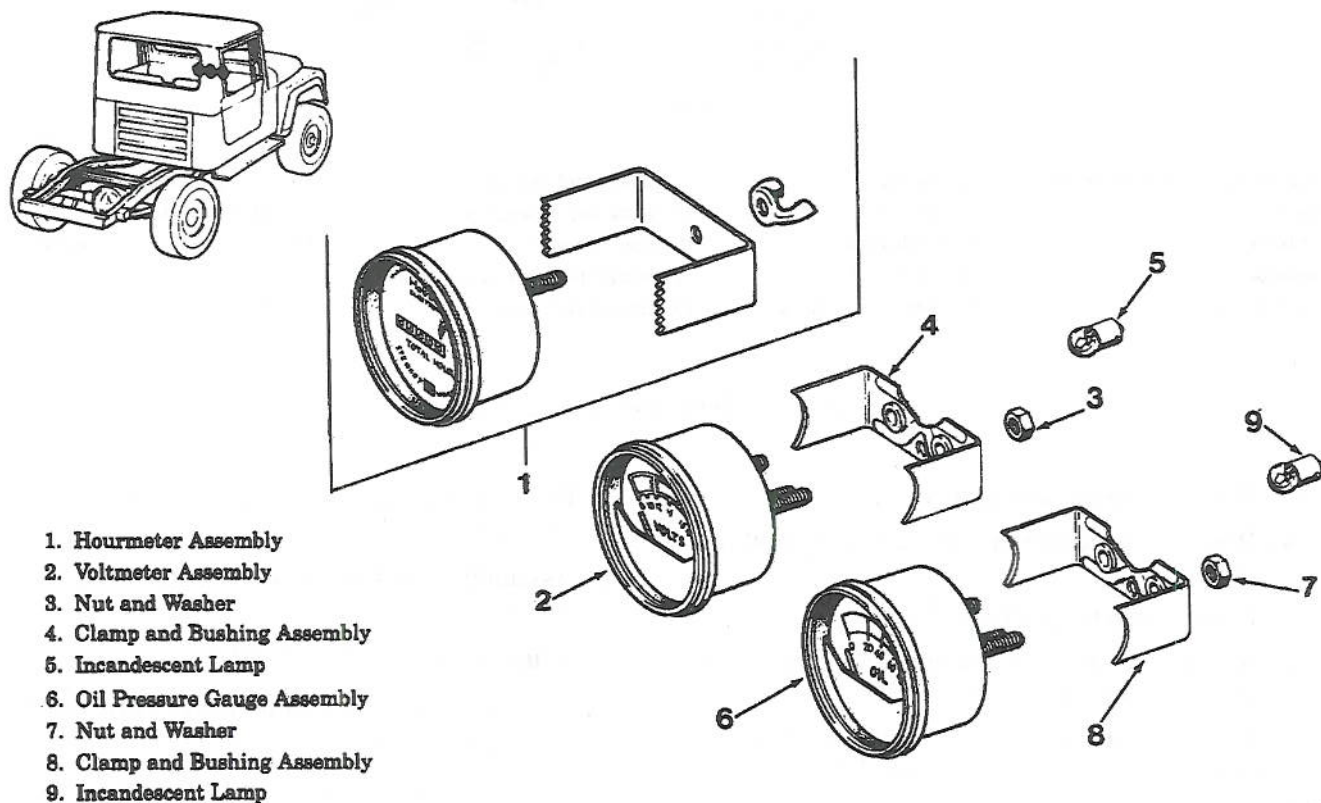
- (5) On new speedometer, unhook odometer retaining clip. Twist and push down to disengage clip.
 - (6) Remove odometer and set to mileage on odometer of old speedometer (13).
 - (7) Install odometer in speedometer (13).
 - (8) Install speedometer (13) and paper tubing (16).
 - (9) Install retainer assembly (12).
 - (10) Install glass and gasket (11) from case and globe assembly (18).
 - (11) Install bezel and gasket (10)
- f. Installation. Install instrument cluster group as follows:
- (1) Connect cluster lamps and electrical connectors.

- (2) Install instrument cluster assembly (1) on instrument panel using attaching screws and hex nuts (2).

5-5.10.19 *Instruments Including Hourmeter Group.* Refer to figure 5-193, and perform the following steps to overhaul the instruments including hourmeter group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove the instruments including hourmeter group as follows:

- (1) Mark bulb and wire connectors, instrument cables.
- (2) Remove nut and washers (7), oil pressure gauge assembly (6) and clamp and bushing assembly (8).
- (3) Remove nuts and washers (3), voltmeter assembly (2) and clamp and bushing assembly (4).
- (4) Remove incandescent lamps (9) and (5).



09892B

Figure 5-193. Instruments Including Hourmeter Group

- (5) Remove wingnut and hourmeter assembly (1).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install the instruments including hourmeter group as follows:
 - (1) Install hourmeter assembly (1) and tighten wingnut.
 - (2) Install incandescent lamps (9) and (5).
 - (3) Install voltmeter assembly (2) and clamp and bushing assembly (4) using nuts and washers (3).
 - (4) Install oil pressure gauge assembly (6) and clamp and bushing assembly (8) using nuts and washers (7).
 - (5) Connect instrument cables.

5-5.10.20 *Instrument Panel Switch Group*. Refer to figure 5-194 and perform the following steps to overhaul the instrument panel switch group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove instrument panel switch group as follows:
 - (1) Refer to paragraph 5-5.10.17 and remove instrument panel.
 - (2) Remove wiring connector from window assembly (14) and remove window assembly (14).
 - (3) Remove knob assembly (9).
 - (4) Remove nut (10), bezel (11) and switch (12).
 - (5) Remove wiring connector from switch assembly (8); disconnect wiring harness (13) and remove switch assembly (8) and wiring harness (13).
 - (6) Remove knob and shaft assembly (4).
 - (7) Remove wiring connector from switch assembly (7).

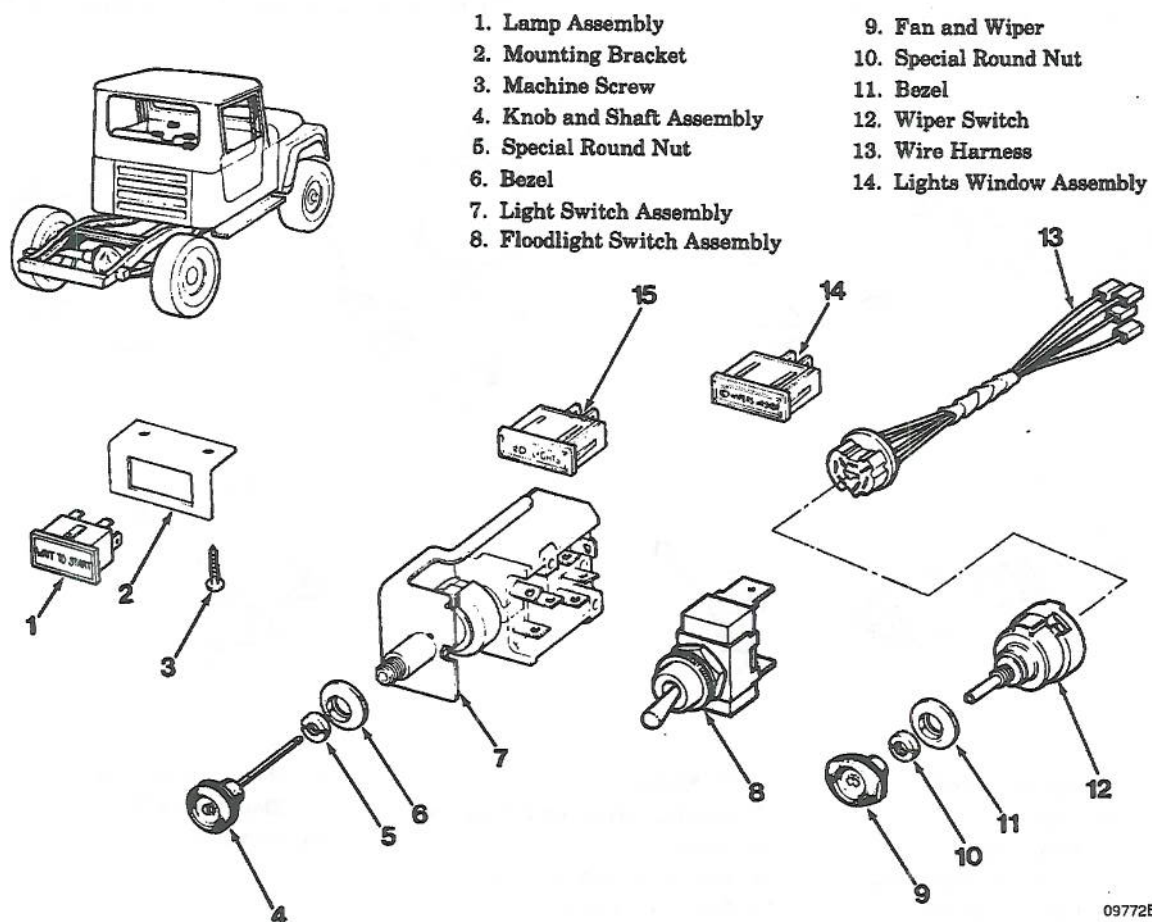


Figure 5-194. Instrument Panel Switch Group

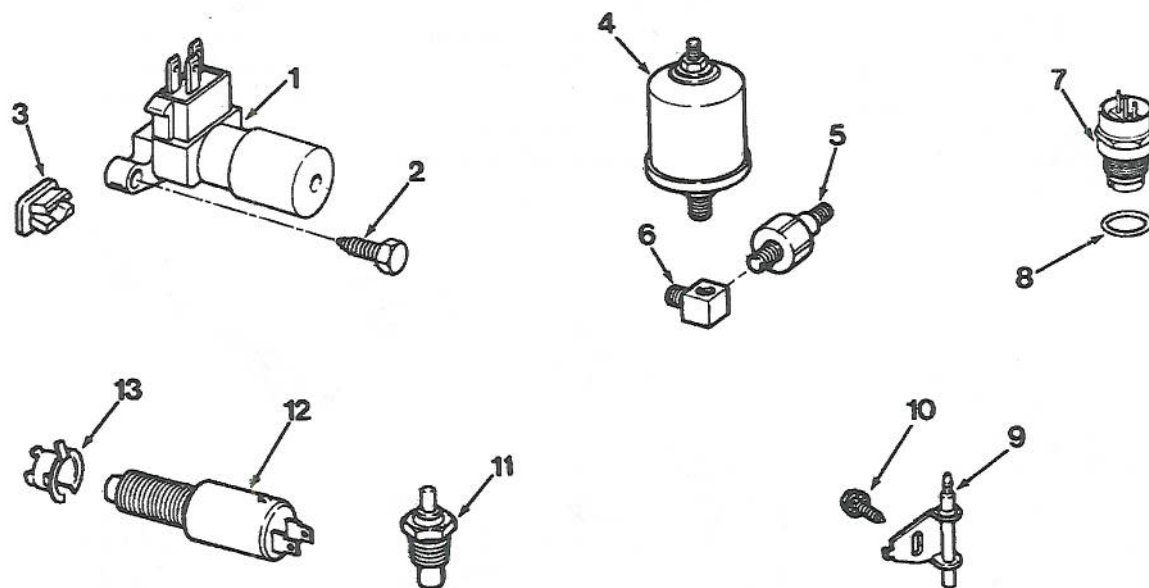
- (8) Remove nut (5), bezel (6) and switch assembly (7).
- (9) Remove machine screw (3) and mounting bracket (2).
- (10) Remove wiring connector from lamp assembly (1) and remove lamp assembly (1).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install instrument panel switch group as follows:
 - (1) Install lamp assembly (1) and connect wiring connector.
 - (2) Install bracket assembly (2) and machine screw (3).
 - (3) Install switch assembly (7) and connect wiring connector.
 - (4) Install bezel (6) and nut (5).

- (5) Install knob and shaft assembly (4).
- (6) Install switch assembly (8) and wiring harness (13); connect wiring connector.
- (7) Install wiper switch (12) and connect wiring connector.
- (8) Install bezel (11) and nut (10).
- (9) Install fan and wiper knob assembly (9).
- (10) Install window assembly (14) and connect wiring connector.
- (11) Refer to paragraph 5-5.10.17 and install instrument panel.

5-5.10.21 *Miscellaneous Switches Group*. Refer to figure 5-195, and perform the following steps to overhaul the miscellaneous switches group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove miscellaneous switches group as follows:

- (1) Remove harness plug from dimmer switch (1).
- (2) Remove capscrew (2) and dimmer switch (1).



09898A

1. Dimmer Switch
2. Capscrew
3. Snap Ring
4. Pressure Transmitter
5. Oil Pressure Switch

6. Y - Fitting
7. Neutral Safety and Backup Switch
8. Gasket
9. Parking Switch Assembly
10. Screw and Washer

11. Temperature Transmitter
12. Electrical Switch
13. Switch Retainer

Figure 5-195. Miscellaneous Switches Group

- (3) Remove snap ring (3).
- (4) Remove attaching screws and remove neutral backup and safety switch (7) and gasket (8) from steering column.
- (5) Remove screw and lockwasher (10) and parking brake switch assembly (9).
- (6) Remove brake pedal and remove wiring harness from electrical switch (12).
- (7) Remove electrical switch (12) from switch retainer (13).
- (8) Remove pressure transmitter (4), oil pressure switch (5) and Y-fitting (6).
- (9) Refer to paragraph 5-5.1.11 and remove temperature transmitter (11).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install miscellaneous switches group as follows:
 - (1) Refer to figure 5-5.1.11 and install temperature transmitter (11).
 - (2) Install Y-fitting (6), oil pressure switch (5) and pressure transmitter (4).
 - (3) Install switch retainer (13) and electrical switch (12).
 - (4) Connect wiring connector to electrical switch (12) and install brake pedal.
 - (5) Install parking brake switch assembly (9) using screw and lockwasher (10).
 - (6) Install gasket (8) and neutral backup and safety switch (7) on steering column using screws.
 - (7) Install snap ring (3).
 - (8) Install dimmer switch (1) using capscrews (2).
 - (9) Connect harness plug to dimmer switch (1).

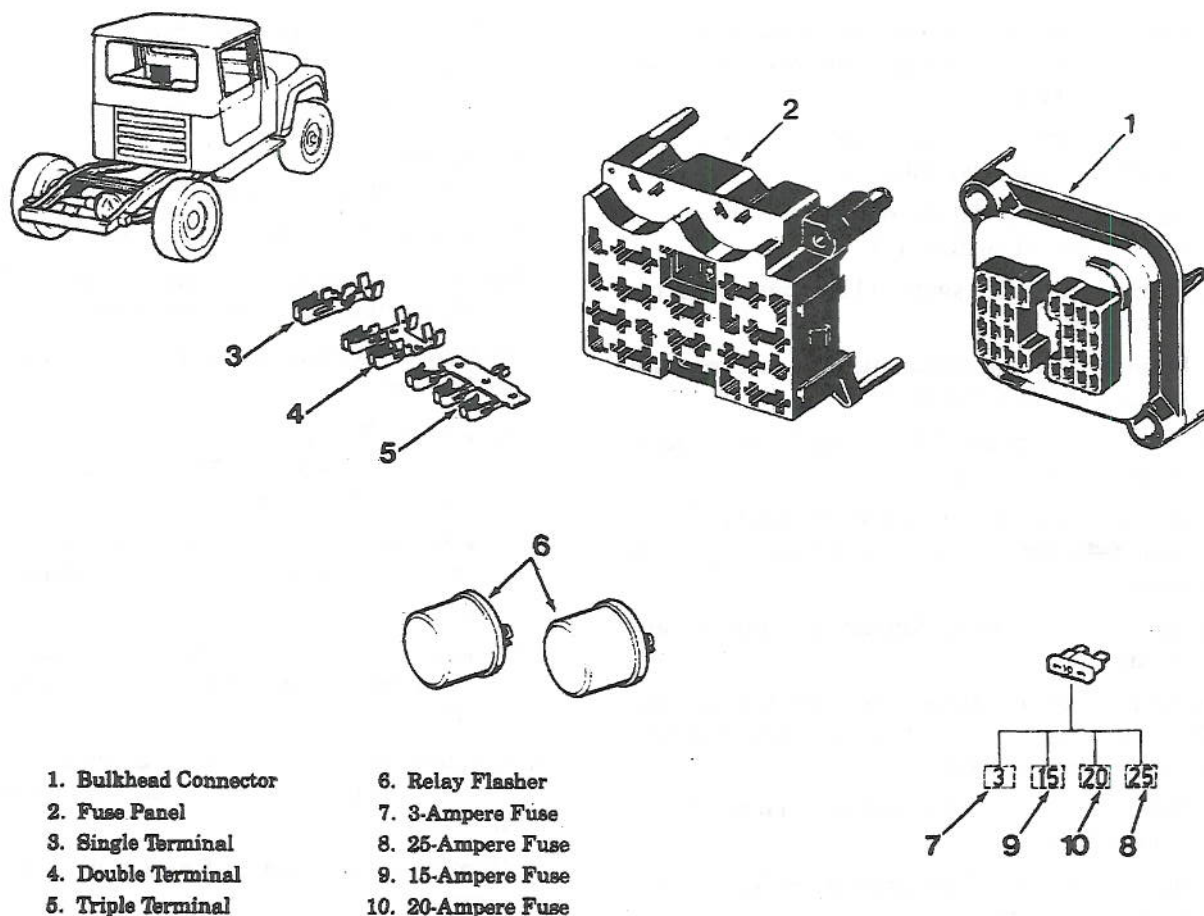
5-5.10.22 *Fuse Panel and Parts Group*. Refer to figure 5-196, and perform the following steps to overhaul the fuse panel and parts group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove fuse panel and parts group as follows:

NOTE

Remove all fuses from fuse panel before disassembly.

- (1) Disconnect battery negative cable.
- (2) Remove fuse panel (2) mounting screws and pull fuse panel (2) away from vehicle.
- (3) Remove relay flashers (6) from fuse panel (2).
- (4) Remove wiring from single terminals (3), double terminals (4) and triple terminal (5).
- (5) Remove terminals (3), (4) and (5) from back of fuse panel (2).
- (6) Remove 3-ampere fuse (7), 25-ampere fuse (18), 15-ampere fuse (9) and 20-ampere fuse (10) from bulkhead connector (1).
- (7) Remove screws attaching bulkhead connector (1) to vehicle and pull bulkhead connector (1) away from vehicle.
- (8) Remove wiring from back of bulkhead connector (1) and remove bulkhead connector (1) from vehicle.
- b. Cleaning inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install fuse panel and parts group as follows:
 - (1) Position bulkhead connector (1) in vehicle and connect wiring to it.
 - (2) Install bulkhead on vehicle using attaching screws.
 - (3) Install 20-ampere fuse (10), 15-ampere fuse (9), 25-ampere fuse (8) and 3-ampere fuse (7).
 - (4) Install single terminals (3), double terminals (4) and triple terminals (5) on back of fuse panel (1).
 - (5) Install wiring on terminals (3), (4) and (5).
 - (6) Install relay flashers (6) on fuse panel (1).
 - (7) Install fuse panel (1) on vehicle.
 - (8) Connect negative battery cable and install fuses in fuse panel (1).



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Figure 5-196. Fuse Panel and Parts Group

5-5.10.23 *Directional, Ignition and Hazard Switches Group.* Refer to figure 5-197, and perform the following steps to overhaul the directional, ignition and hazard switches group.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove directional, ignition and hazard switches group as follows:

- (1) Disconnect negative battery cable.
- (2) Remove horn center button by pulling straight out.
- (3) Remove screws, bushing, receiver and spring.
- (4) Remove steering wheel nut.

NOTE

Before removing steering wheel, note alignment of steering wheel to steering shaft index marks for later assembly reference.

- (5) Remove steering wheel with steering wheel puller #J-21232-01.
- (6) Remove lockplate cover.
- (7) Use lockplate compressor tool #J-23653 to depress lockplate.
- (8) Remove snap ring from steering shaft groove.
- (9) Remove lockplate compressor tool, snap ring and lockplate.
- (10) Remove retainer (1), pin (2), spring (3) and cam (4).
- (11) Remove upper bearing preload spring and thrust washer.
- (12) Place lever assembly (5) in right hand turn position, remove screw (6) and remove lever.
- (13) Depress hazard knob (11) and remove it by turning in counterclockwise direction.

5-5.10.24 *Ignition Switch Lock Cylinder Group*. Refer to figure 5-198, and perform the following steps to overhaul the ignition switch lock cylinder group.

a. Removal and disassembly. Disassembly is accomplished during removal. Refer to paragraph 5-5.4.2 and remove upper steering column. Remove ignition switch lock cylinder group as follows:

- (1) Bend tab on antitheft ring (7) out.
- (2) Insert key (1) into ignition lock assembly (2) and turn cylinder slightly.
- (3) Depress tab on case (8); withdraw key (1) and cylinder (9) from case (8).
- (4) Remove washer (6) and antitheft ring (7).

NOTE

Remove tumbler retainer carefully to avoid loosening tumbler springs.

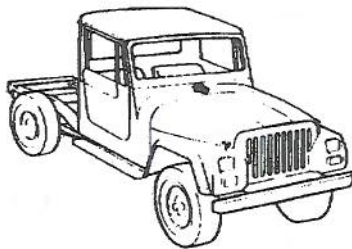
- (5) Remove tumblers retainer (3).
- (6) Remove tumbler spring (4) and tumblers (5) from cylinder (9).

b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

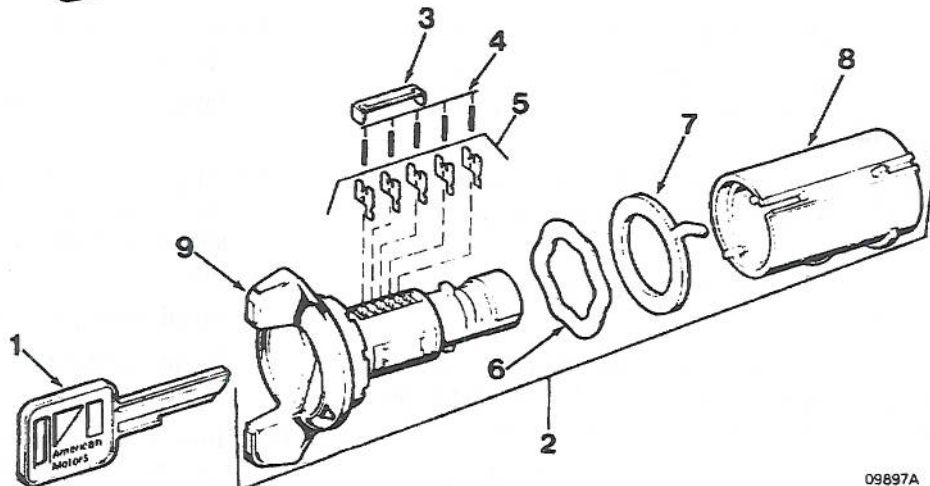
c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install ignition switch lock cylinder group as follows:

- (1) Insert tumblers (5) and tumbler springs (4) in cylinder (9).
- (2) Install tumblers retainer (3).
- (3) Install antitheft ring (7) and washer (6).
- (4) Depress tab on case (8); insert key (1) and cylinder (9) into case (8).
- (5) Release tab on case (8), turn key (1) and cylinder (9) back slightly and remove key (1) from ignition lock assembly (2).
- (6) Refer to paragraph 5-5.4.2 and install upper steering column.



- | | |
|---------------------------|-------------------|
| 1. Key | 6. Washer |
| 2. Ignition Lock Assembly | 7. Antitheft Ring |
| 3. Tumblers Retainer | 8. Case |
| 4. Tumbler Springs | 9. Cylinder |
| 5. Tumblers | |

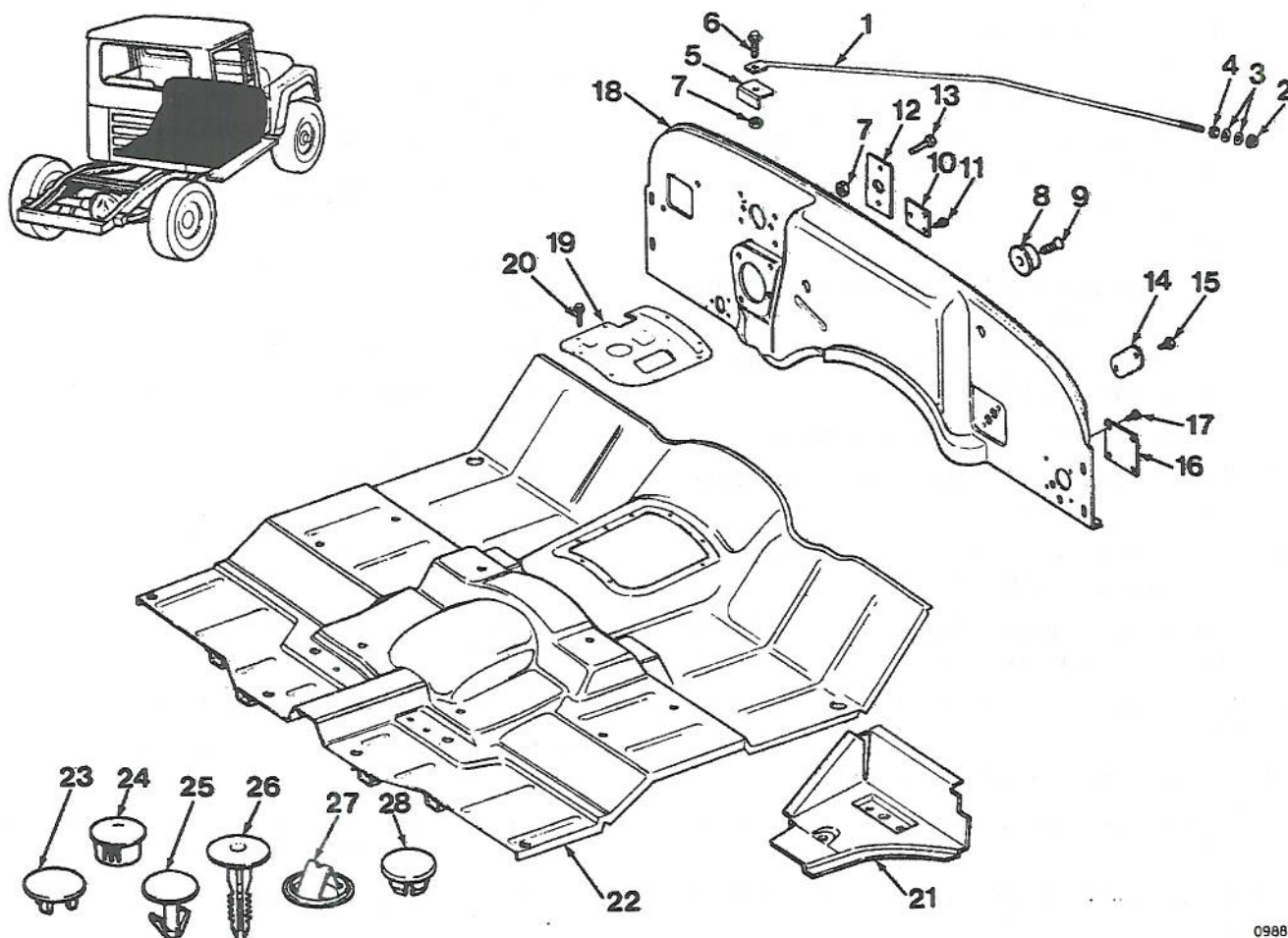


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Figure 5-198. Ignition Switch Lock Cylinder Group

5-5.10.25 *Floor Pan, Cowl and Dash Panel Group*. Refer to figure 5-199, and perform the following steps to overhaul the floor pan, cowl and dash panel group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove floor pan, cowl and dash panel group as follows:
 - (1) Refer to paragraph 5-5.10.17 and remove instrument panel.
 - (2) Refer to paragraph 5-5.4.3 and remove steering column assembly.
 - (3) Remove hex nuts (2), flat washers (3) and tie rods (1) from air deflector.
 - (4) Remove flat washers (3) and hex nuts (4).
 - (5) Remove hex nuts (7), screws and lockwashers (6) and tie rods (1).
 - (6) Remove panel assembly (18) and brackets (5) from panel assembly (18).
 - (7) Remove screw and washers (13), hex nuts (7) and stabilizer bumpers (12).
 - (8) Remove pan head screws (11) and cover plate (10).
 - (9) Remove screws (9) and cover plate (8).
 - (10) Remove pan head screws (15) and cover plate (14).
 - (11) Remove screws and washers (17) and cover plate (16).
 - (12) Refer to paragraph 5-5.10.2 and remove front seat track.
 - (13) Remove mat and carpet plugs (26).
 - (14) Refer to paragraph 5-5.10.27 and remove floor covering.
 - (15) Remove pan head screws (20) and cover assembly (19).
 - (16) Refer to paragraph 5-5.2.1 and remove shifting.
 - (17) Refer to paragraph 5-5.9.2 and remove body hold-downs.
 - (18) Remove floor pan assembly (22) and bracket assembly (21).
 - (19) Remove bracket assembly (21) from floor pan assembly (22).
 - (20) Remove button plugs (23), (24), (25), (27) and (28).
- b. Cleaning inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install floor pan, cowl and dash panel group as follows:
 - (1) Install button plugs (23), (24), (25), (27) and (28).
 - (2) Install bracket assembly (21) on floor pan assembly (22).
 - (3) Install floor pan assembly (22).
 - (4) Refer to paragraph 5-5.9.2 and install body hold-downs.
 - (5) Refer to paragraph 5-5.2.1 and install shifting.
 - (6) Install cover assembly (19) using pan head screw (20).
 - (7) Refer to paragraph 5-5.10.27 and install floor covering.
 - (8) Install mat and carpet plugs (26).
 - (9) Refer to paragraph 5-5.10.2 and install front seat track.
 - (10) Install cover plate (16) on panel assembly (18) using screws and washers (17).
 - (11) Install cover plate (14) using pan head screws (15).
 - (12) Install cover plate (8) using screws (9).
 - (13) Install cover plate (10) using pan head screws (11).
 - (14) Install stabilizer bumpers (12) using screws and washers (13) and hex nuts (7).
 - (15) Install brackets (5) on panel assembly (18).
 - (16) Install panel assembly (18).
 - (17) Install tie rods (1) on panel assembly (18) using screws and lockwashers (6) and hex nuts (7).
 - (18) Install hex nuts (4) and flat washers (3) on tie rods (1) and install tie rods (1) on air deflector.
 - (19) Install flat washers (3) and hex nuts (2) on tie rod (1) to secure it to air deflector.
 - (20) Refer to paragraph 5-5.4.3 and install steering column assembly.
 - (21) Refer to paragraph 5-5.10.17 and install instrument panel.



09887B

- | | | |
|-------------------------|-----------------------|-------------------------|
| 1. Tie Rod | 10. Cover Plate | 19. Cover Assembly |
| 2. Nut and Washer | 11. Pan Head Screw | 20. Pan Head Screw |
| 3. Flat Washer | 12. Stabilizer Bumper | 21. Bracket Assembly |
| 4. Hex Nut | 13. Screw and Washer | 22. Floor Pan Assembly |
| 5. Bracket | 14. Cover Plate | 23. Button Plug |
| 6. Screw and Lockwasher | 15. Pan Head Screw | 24. Button Plug |
| 7. Hex Nut | 16. Cover Plate | 25. Button Plug |
| 8. Cover Plate | 17. Screw and Washer | 26. Mat and Carpet Plug |
| 9. Screw | 18. Panel Assembly | 27. Button Plug |

Figure 5-199. Floor Pan, Cowl and Dash Panel Group

5-5.10.26 Accelerator Pedal and Linkage Group. Refer to figure 5-200, and perform the following steps to overhaul the accelerator pedal and linkage group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove accelerator pedal and linkage group as follows:

- (1) Remove cable assembly (5) from pedal and rod assembly (1).

- (2) Remove other end of cable assembly (5) from accelerator wire bracket on venturi.
- (3) Remove screws and washers (2) and remove pedal and rod assembly (1) from floor of vehicle.
- (4) Remove accelerator pedal (3) and clevis spring (4).

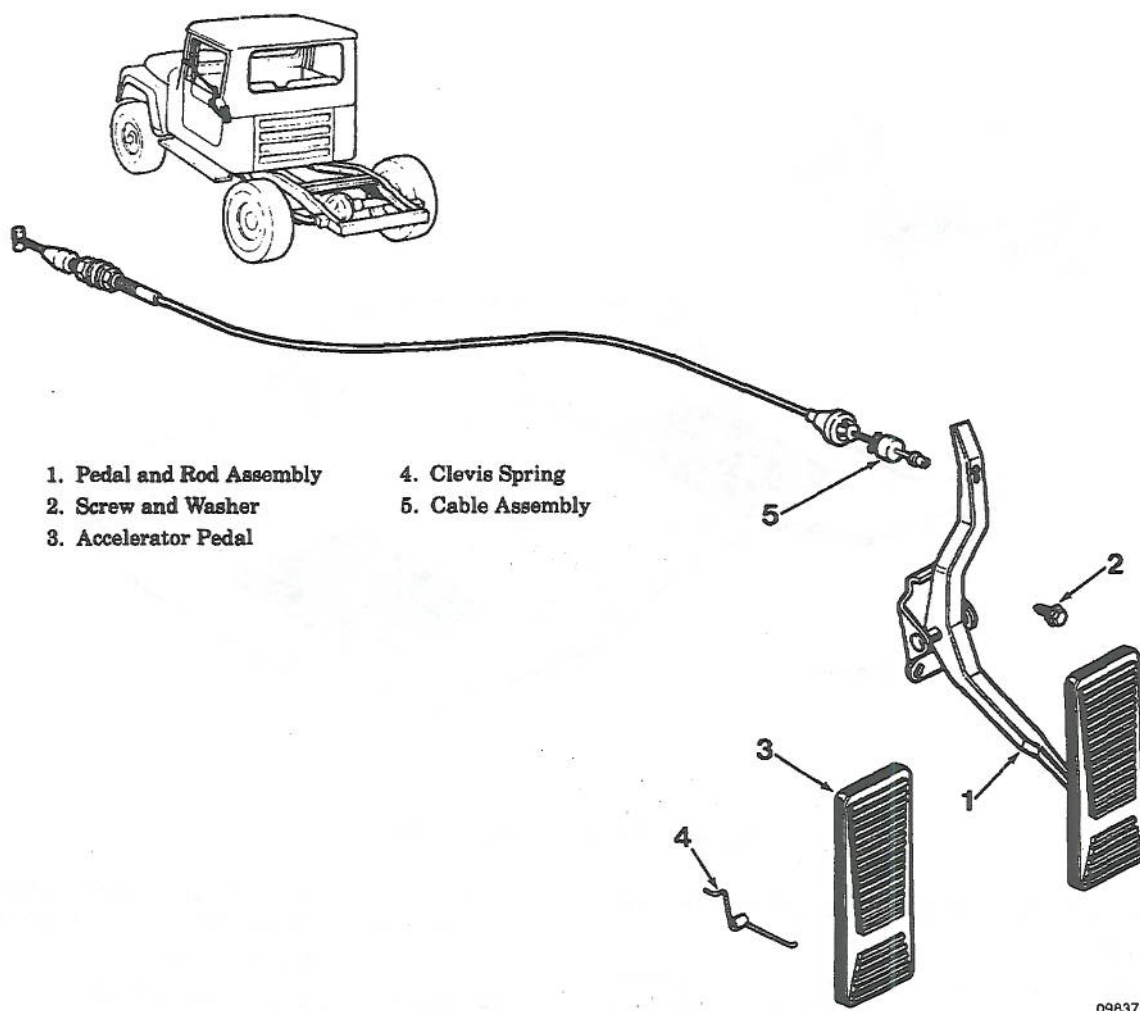


Figure 5-200. Accelerator Pedal and Linkage Group

- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace all worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install accelerator pedal and linkage group as follows:
 - (1) Install accelerator pedal (3) and clevis spring (4) on pedal and rod assembly (1).
 - (2) Install pedal and rod assembly (1) on vehicle floor using screws and washers (2).
 - (3) Install cable assembly (5) in accelerator wire bracket on venturi.
 - (4) Install other end of cable assembly in pedal and rod assembly (1).

5-5.10.27 *Floor Mat Group*. Refer to figure 5-201, and perform the following steps to overhaul the floor mat group.

- a. Removal and disassembly. Disassembly is accomplished during removal. Remove floor mat group as follows:
 - (1) Refer to paragraphs 5-5.10.1 and 5-5.10.3 and remove front seat.
 - (2) Refer to paragraph 5-5.10.2 and remove front seat track.
 - (3) Remove trim around shifter, if present.
 - (4) Remove mat assembly (1).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.

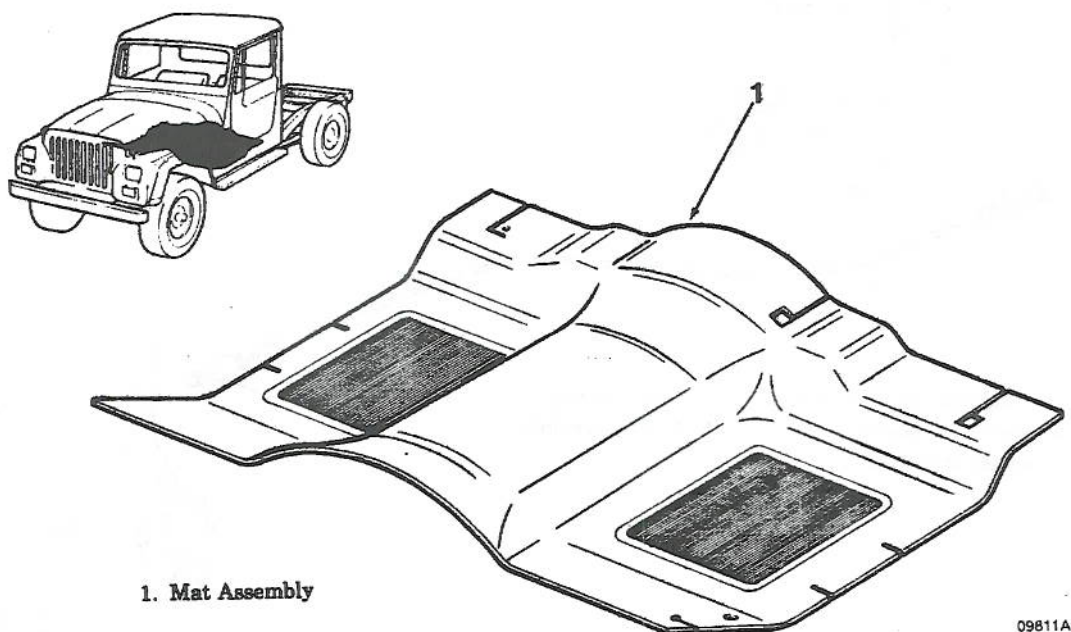


Figure 5-201. Floor Mat Group

c. Repair and replacement. Replace all worn or damaged parts.

d. Assembly and installation. Assembly is accomplished during installation. Install floor mat group as follows:

- (1) Install mat assembly (1).
- (2) Install trim around shifter if removed.
- (3) Refer to paragraph 5-5.10.2 and install front seat track.
- (4) Refer to paragraphs 5-5.10.1 and 5-5.10.3 and install front seat. If new mat is being installed, it may be necessary to cut holes for certain components.

5-5.10.28 *Electrical Assembly*. Refer to figure 5-202, and perform the following steps to overhaul the electrical assembly.

a. Removal and disassembly. Disassembly is accomplished during removal. Remove electrical assembly as follows:

- (1) Remove light assembly (1) by removing machine screws (3) and inserts (4) and remove mounting base (5), gasket (6) and light assembly (2) from vehicle.
- (2) Remove connector (7) and terminal (8).

(3) Remove nut from threaded nipple at base of light assembly (2) and remove light assembly (2) from mounting base (5).

(4) Remove light assembly (11) by removing machine screws (13) and inserts (14) and remove mounting plate (15), mounting gasket (16) and light assembly (12) from vehicle.

(5) Remove connector (17) and terminal (18).

(6) Remove nut and hollow bolt and remove light assembly (12) from mounting plate (15).

(7) Remove terminals (31). Tag wires for assembly reference.

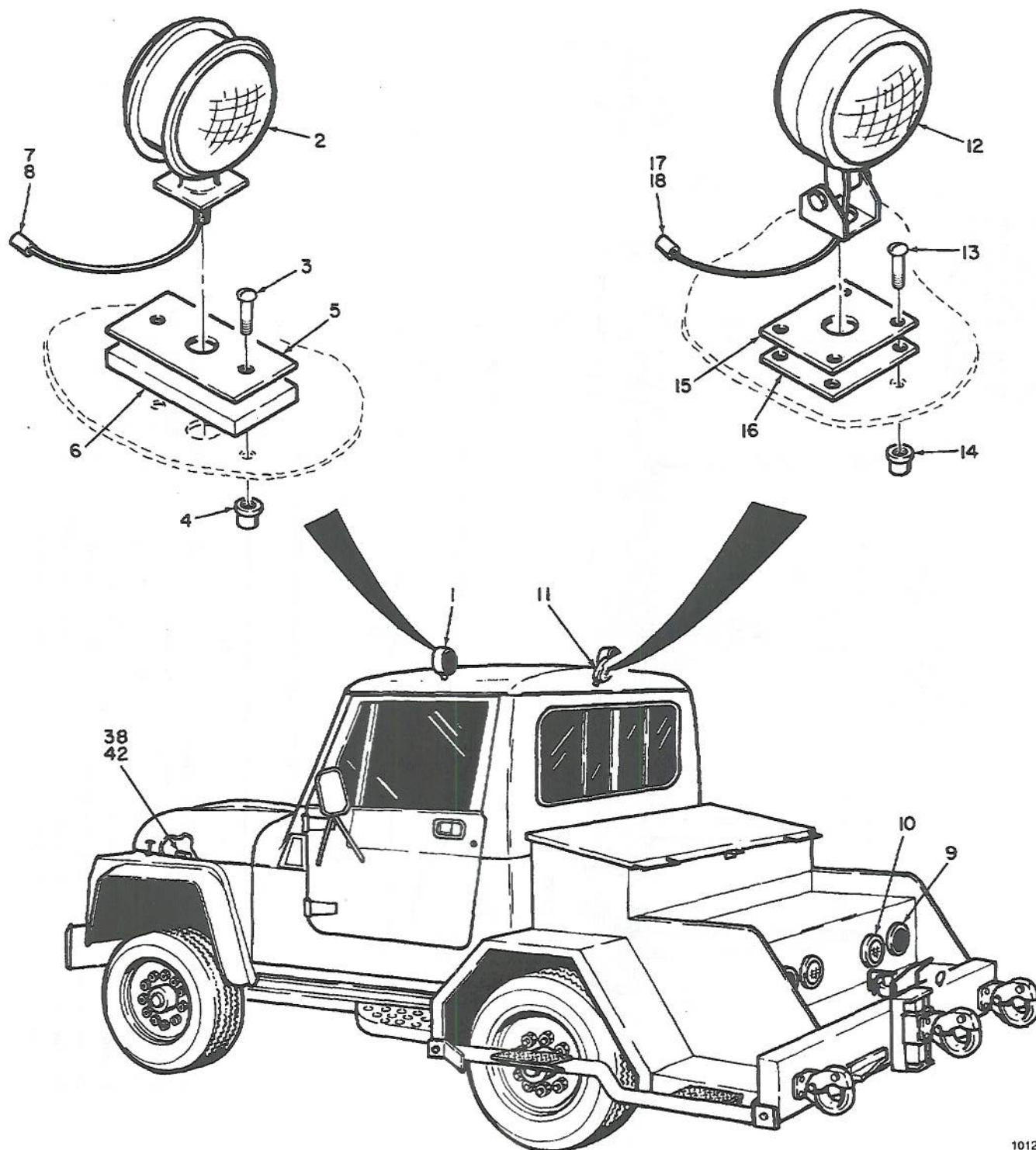
(8) Remove connector (19) and terminal (32).

(9) Remove capscrews (21), flat washers (22), lockwashers (23), hex nuts (24), and terminal stud (37). Remove receptacle (20) and receptacle boot (25).

(10) Remove connector plugs (26) and (27) from light assemblies (9) and (10). Tag wires for assembly reference.

(11) Remove light assemblies (9) and (10).

(12) Remove wire splices (28) and male connectors (29). Tag wires for assembly reference.



- 1. Light Assembly
- 2. Light Assembly
- 3. Machine Screw
- 4. Insert
- 5. Mounting Base

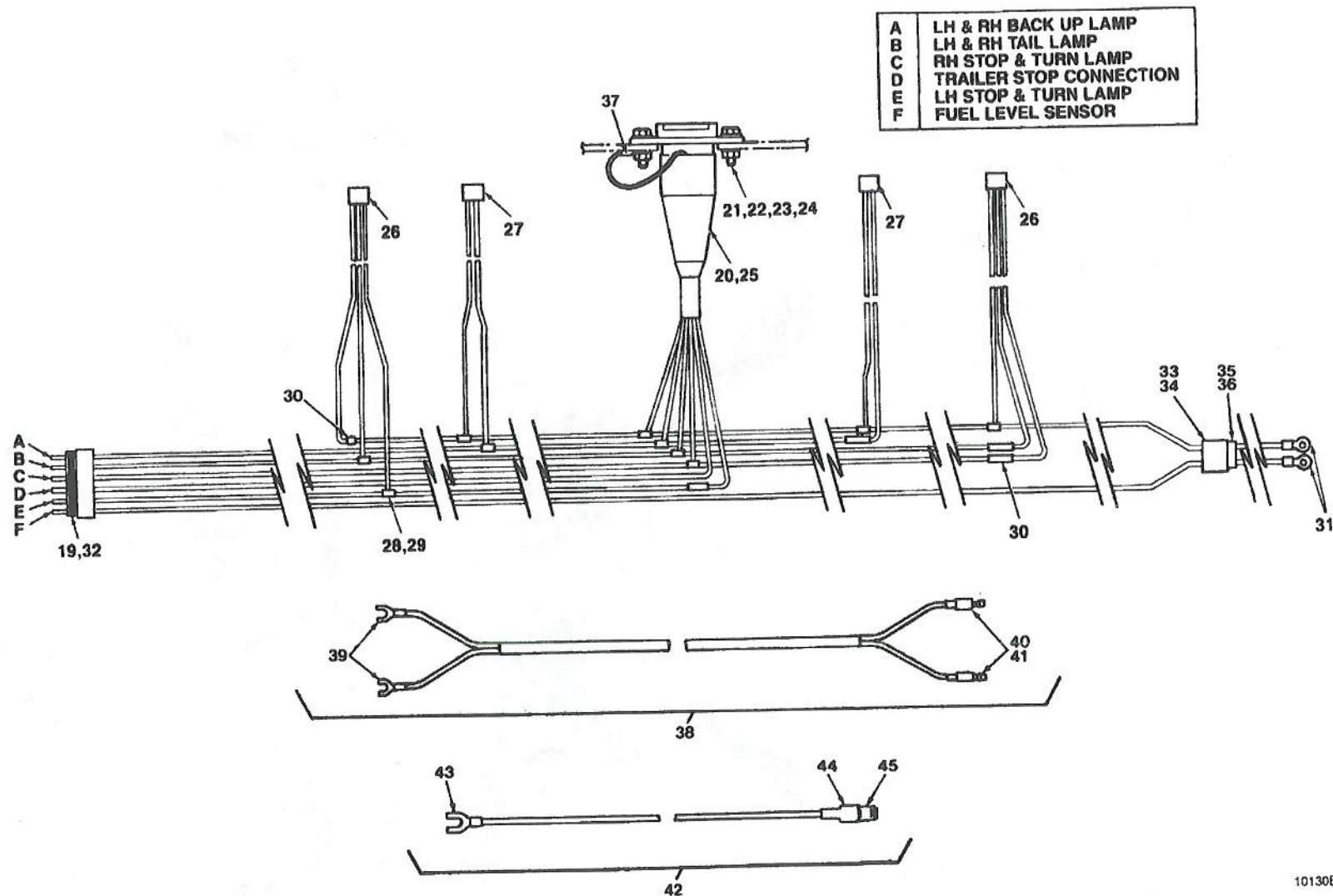
- 6. Gasket
- 7. Connector
- 8. Terminal
- 9. Light Assembly
- 10. Light Assembly

- 11. Light Assembly
- 12. Light Assembly
- 13. Machine Screw
- 14. Insert
- 15. Mounting Plate

- 16. Gasket
- 17. Connector
- 18. Terminal

Figure 5-202. Electrical Assembly (Sheet 1 of 2)

10120B



10130B

Figure 5-202. Electrical Assembly (Sheet 2 of 2)

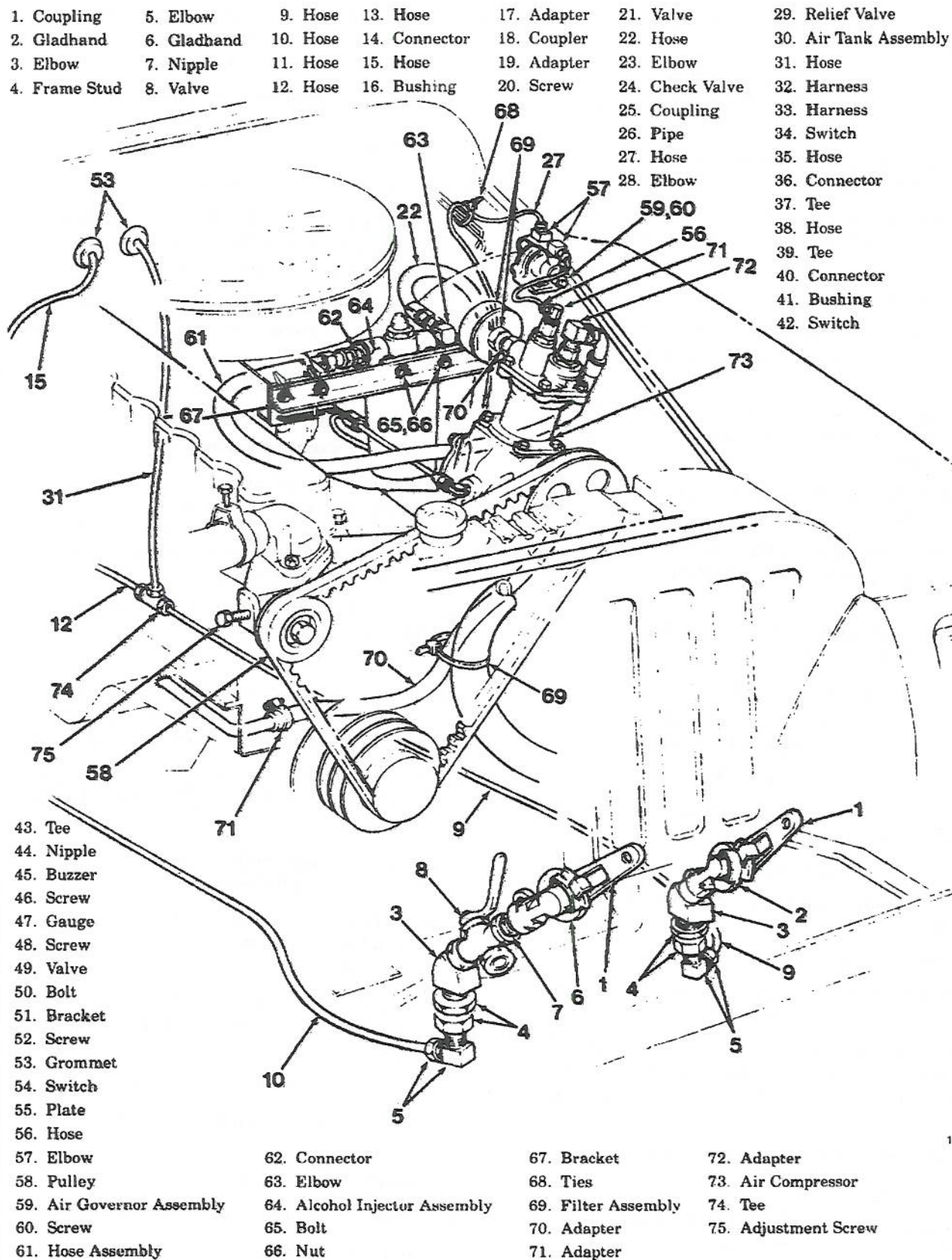
- (13) Remove butt connectors (30). Tag wires for assembly reference.
 - (14) Remove connector bodies (33) and (35) from terminals (34) and (36). Tag wires for assembly reference.
 - (15) Remove tongue terminals (39). Tag wires for assembly reference.
 - (16) Remove bullet connector (40) and bullet receptacle (41) and tag for assembly reference.
 - (17) Remove tongue terminal (43) and tag wire for assembly reference.
 - (18) Remove connector (44) and splice (45) and tag wires for assembly reference. Remove wire harness (42).
- b. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Repair and replacement. Replace any worn or damaged parts.
- d. Assembly and installation. Assembly is accomplished during installation. Install electrical assembly as follows:
- (1) Install wire harness (42), connecting splice (45) and connector (44).
 - (2) Install tongue terminal (43).
 - (3) Install harness assembly (38) and connect bullet receptacle (41) and bullet connector (40).
 - (4) Connect tongue terminal (39).
 - (5) Install connector bodies (33) and (35) to terminals (34) and (36).
 - (6) Install butt connectors (30).
 - (7) Install male connectors (29) and wire splices (28).
 - (8) Install light assemblies (9) and (10).
 - (9) Install connector plugs (26) and (27) on light assemblies (9) and (10).
 - (10) Install receptacle (20) and receptacle book (25) using capscrews (21), flat washers (22), lockwashers (23) and hex nuts (24). Install terminal stud (37).
 - (11) Install terminal (32) and connector (19).
 - (12) Install terminals (31).
 - (13) Install light assembly (12) on mounting plate (15) using hollow bolt and nut.
 - (14) Install connector (17) and terminal (18).
 - (15) Install light assembly (11) by installing mounting gasket (16), mounting plate (15) and light assembly (12) using screws (13) and inserts (14).
 - (16) Install light assembly (2) on mounting base (5) and install nut on threaded nipple at base of light assembly (2).
 - (17) Install connector (7) and terminal (8).
 - (18) Install light assembly (1) by installing gasket (6), mounting base (5) and light assembly (2) using machine screws (3) and inserts (4).
- 5-5.11 *Air System Installation*. Refer to figures 5-203 through 5-208 for removal, assembly, and installation procedures.

WARNING

Depressurize system before attempting any service or repair that requires disassembly of any pressurized components. Severe injury or death can result if system remains pressurized during any component removal.

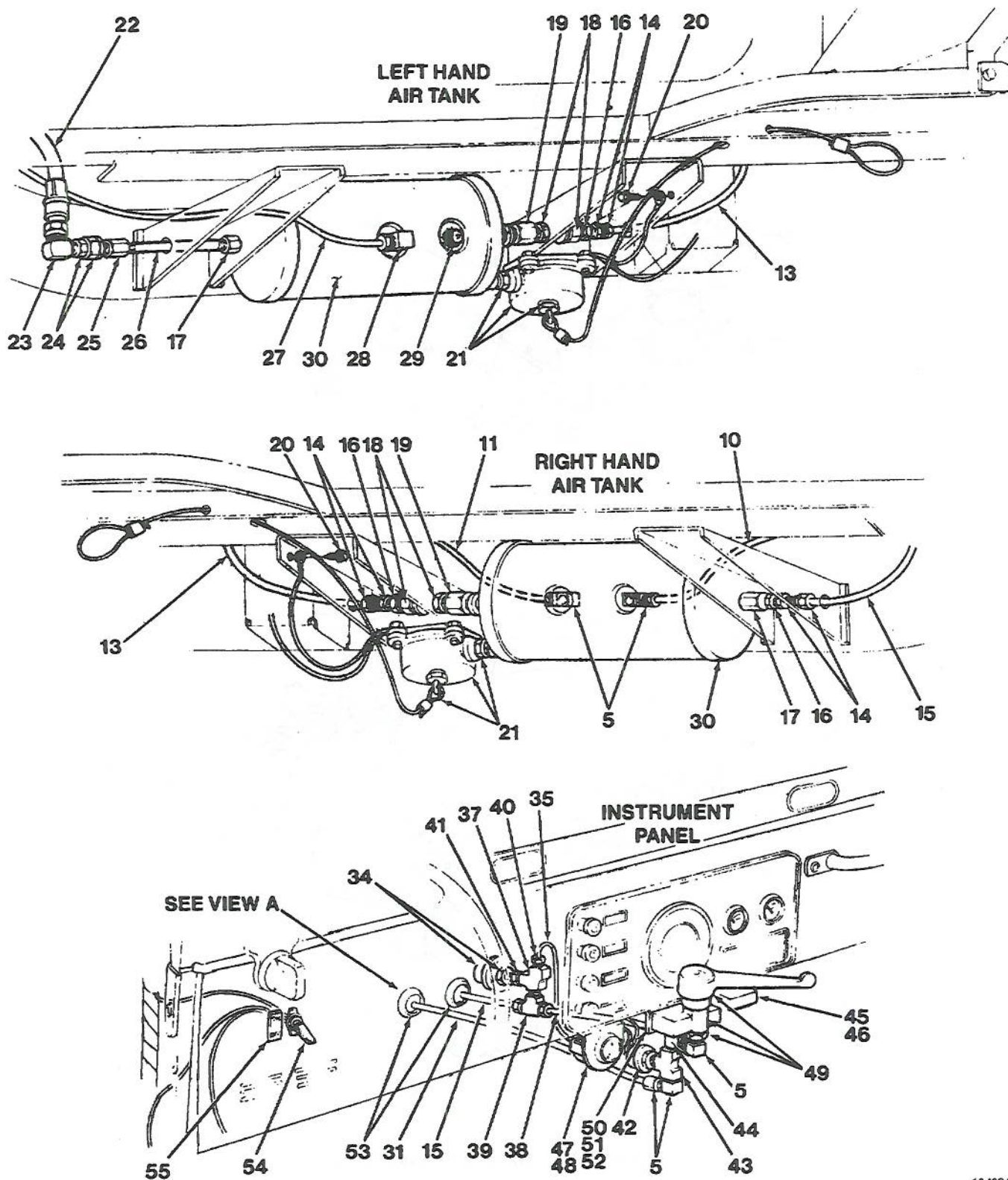
Do not work under raised vehicle without first supporting vehicle with safety jack stands or injury to personnel may result.

- a. Removal. Raise and secure vehicle as necessary to facilitate removal of component parts under chassis. Remove air system components as follows:
- (1) Loosen belt tension to air compressor pulley using screw (75, fig. 5-203). Remove belt from vehicle.
 - (2) Remove the idler pulley assembly (figure 5-204) if necessary as follows:
 - (a) Remove screws (2), outlet (1), gasket (3), bracket (9), and gasket (3) from water pump assembly.
 - (b) Rotate pulley (4) counterclockwise, removing pulley (4), shield (5), and spacer (6) from bolt (7).
 - (c) Remove screw (8) from bolt (7).
 - (3) Remove filter assembly (69, fig. 5-203) and element.
 - (4) Remove hose (56) from adaptor (71).
 - (5) Remove hose assembly (61) from adapter (72).
 - (6) Remove tube (4, figure 5-205) from connector (5).



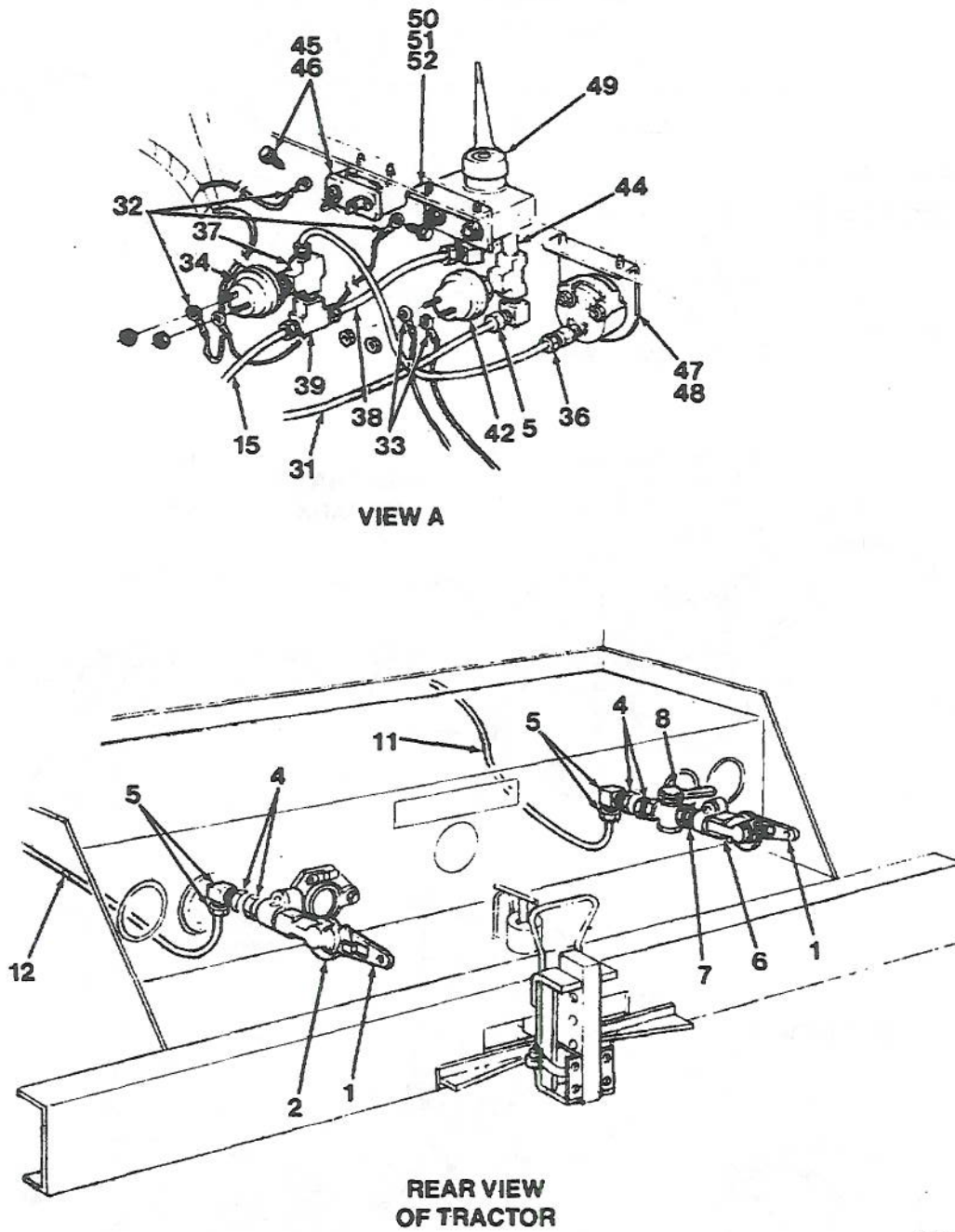
13431A

Figure 5-203. Air System Installation (Sheet 1 of 3)



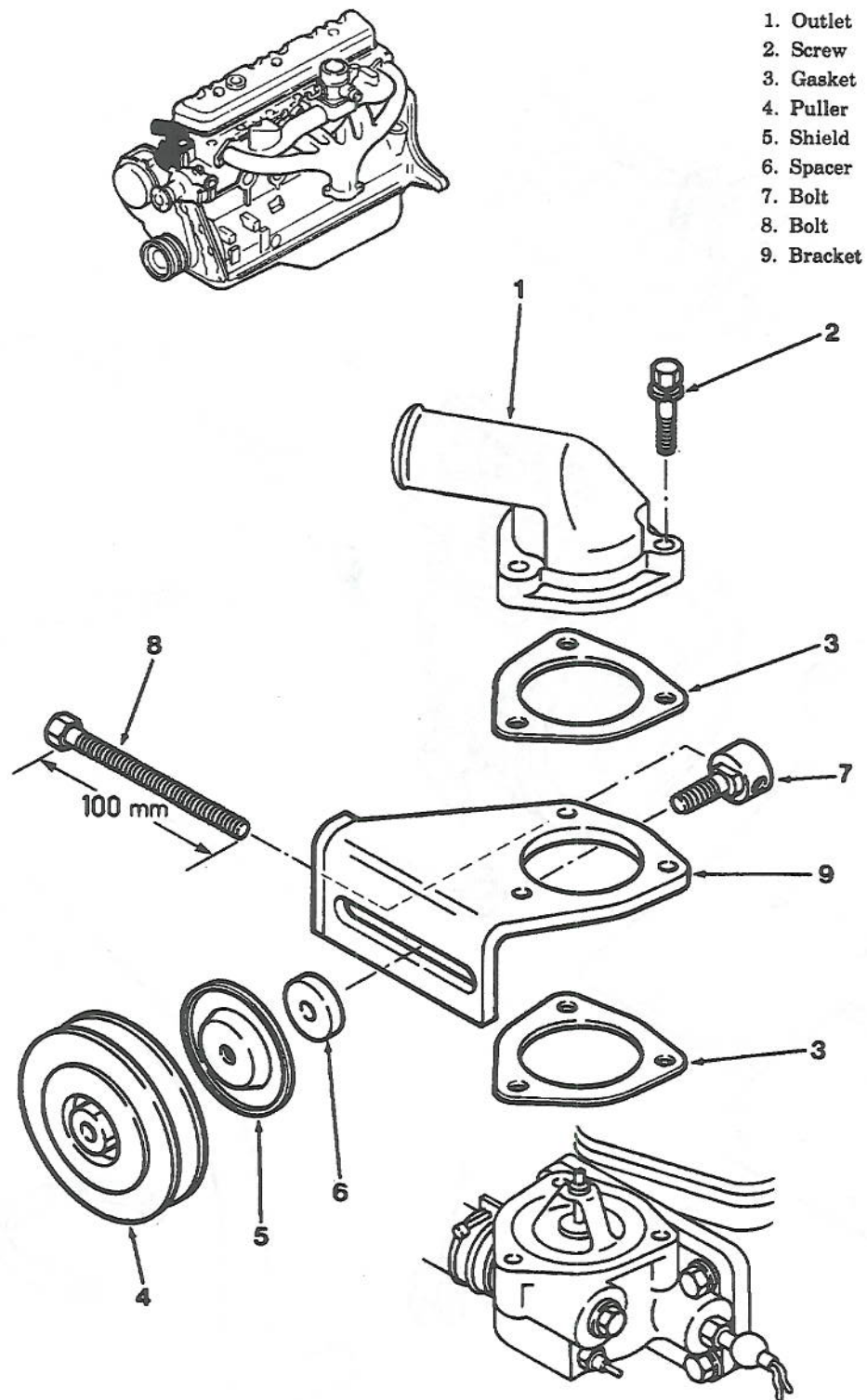
13432A

Figure 5-203. Air System Installation (Sheet 2 of 3)



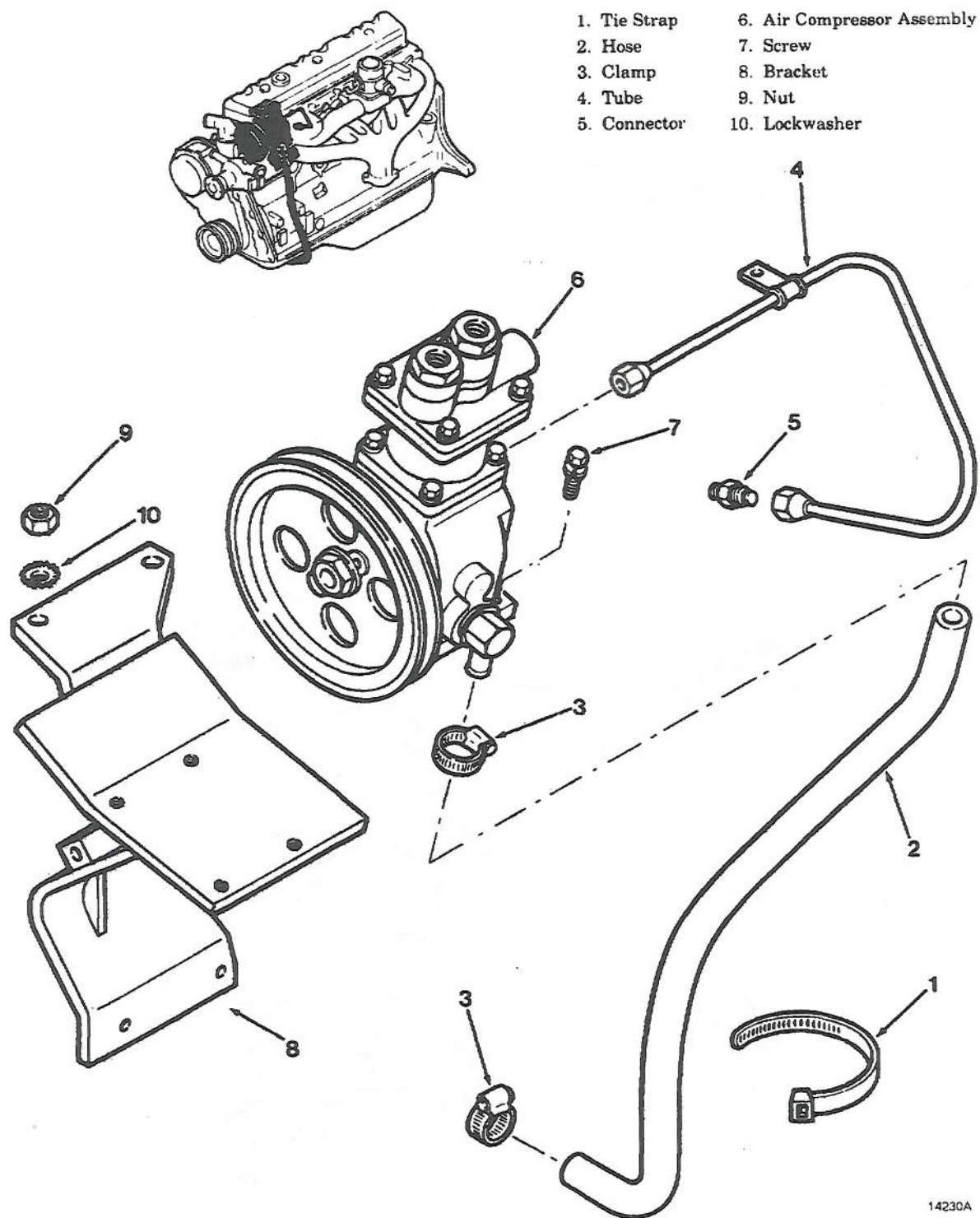
13433A

Figure 5-203. Air System Installation
(Sheet 3 of 3)



14231A

Figure 5-204. Idler Pulley Mounting



14230A

Figure 5-205. Air Compressor Installation

- (7) Drain engine oil as necessary per paragraph 4-4.1. Loosen clamps (3), and remove hose (2).
- (8) Remove screws (7) and compressor from vehicle. Refer to step b(1) for compressor disassembly procedures.
- (9) Remove nuts (9), lockwashers (10), and bracket (8).
- (10) Remove hoses (61 and 22, fig. 5-203) from connector (62) and elbow (63).

WARNING

Methanol alcohol is flammable. Ensure ignition is off and engine is cool before draining and/or adding alcohol to the alcohol injector. Severe burns can result if engine is hot or the engine is left running.

- (11) Open drain cock on bottom of alcohol injector (64) draining all fluid into an approved container.
- (12) Remove bolts (65), nuts (66), and alcohol injector assembly (64) from mounting bracket (67). Refer to step b(2) for alcohol injector disassembly procedures.
- (13) Remove hoses (27 and 71) from governor assembly (59).
- (14) Remove screws (60) and governor assembly (59). Refer to step b(3) for governor disassembly procedures.
- (15) Remove front gladhand assembly as follows:
 - (a) Remove coupling (1) from gladhand (2).
 - (b) Remove gladhand (2) and elbow (3) from frame stud (4).
 - (c) Remove hose (9) from elbow (5).
 - (d) Remove elbow (5) from frame stud (4).
 - (e) Remove frame stud (4) from frame.
- (16) Remove front gladhand and valve assembly as follows:
 - (a) Remove coupling (1) from gladhand (6).
 - (b) Remove gladhand (6), nipple (7), valve (8), and elbow (3) from frame stud (4).
 - (c) Remove hose (1) from elbow (5).
 - (d) Remove elbow (5) from frame stud (4).
 - (e) Remove frame stud (4) from frame.
- (17) Remove rear gladhand assembly as follows:
 - (a) Remove coupling (1) from gladhand (2).
 - (b) Remove gladhand (2) from frame stud (4).
 - (c) Remove hose (12) from elbow (5).
 - (d) Remove elbow (5) from frame stud (4).
 - (e) Remove frame stud (4) from frame.
- (18) Remove rear gladhand and valve assembly as follows:
 - (a) Remove coupling (1) from gladhand (6).
 - (b) Remove gladhand (6), nipple (7), and valve (8) from frame stud (4).
 - (c) Remove hose (11) from elbow (5).
 - (d) Remove elbow (5) from frame stud (4).
 - (e) Remove frame stud (4) from frame.
- (19) Remove hoses (19, 12, and 31) from tee (74).
- (20) Remove component parts located under and on dashboard as follows:
 - (a) Remove nuts from switch (34). Tag and remove wires (32).
 - (b) Remove switch (34) from elbow (37).
 - (c) Remove hose (35) from elbow (37).
 - (d) Remove elbow (37) from elbow (39).
 - (e) Remove hoses (15 and 38) and elbow (39).
 - (f) Remove hose (38) from elbow (5).
 - (g) Remove elbow (5) from valve (49).
 - (h) Remove nuts from switch (42). Tag and remove wires (33).
 - (i) Remove switch (42) from tee (43).
 - (j) Remove hose (31) from elbow (5).
 - (k) Remove elbow (5), tee (43), and nipple (44) from valve (49).
 - (l) Remove bolts (50) and valve (49) from bracket (51).
 - (m) Remove screws (52) and bracket (51) from dashboard.
 - (n) Remove hose (35) from connector (36).
 - (o) Remove screws (48) and gauge (47) from dashboard.
 - (p) Remove connector (36) from gauge (47).
 - (q) Remove screws (46) and buzzer (45) from dashboard. Tag wires (32), and remove screws and wires (32) from buzzer (45).
 - (r) Remove switch (54) from dashboard. Tag and remove wires from switch (54).

(21) Remove components from left-hand air tank as follows:

- (a) Remove hose (28) from air tank assembly (30).
- (b) Remove screw (20). Tag and remove wires connected to heater and drain valve assembly (21).
- (c) Remove plug from heater and drain valve assembly (21).
- (d) Loosen adapter on heater and drain valve assembly (21), and remove heater and drain valve assembly (21) from air tank assembly (3).
- (e) Remove hose (22), elbow (23), check valve (24), coupling (25), and pipe (26) from adapter (17).

WARNING

Before attempting removal of the air tank assembly, it must be safely supported. The support is used to protect maintenance personnel from severe injury if the tank would drop suddenly during removal procedures.

- (f) Remove adapter (17) from air tank assembly (30).
 - (g) With air tank assembly (30) securely supported, loosen adapter (19) and carefully remove air tank assembly (30).
 - (h) Remove elbow (28) and relief valve (29) from air tank assembly (30).
 - (i) Remove hose (13), connector (14), and bushing (16) from frame coupler (18).
 - (j) Remove adapter (19) and frame coupler (18).
- (22) Remove components from the right-hand air tank assembly (30) as follows:
- (a) Remove hoses (11 and 10) from elbows (5).
 - (b) Remove screw (20). Tag and remove wires connected to heater and valve assembly (21).
 - (c) Remove plug from heater and valve assembly (21).
 - (d) Loosen adapter connected to air tank assembly (30) to heater and drain valve assembly (21), and remove heater and drain valve assembly.
 - (e) Remove hose (15), connector (14), and bushing (16) from adapter (17).

WARNING

Before attempting removal of the air tank assembly, it must be safely supported. The support is used to protect maintenance personnel from severe injury if the tank would drop suddenly during removal procedures.

- (f) Remove adapter (17) from tank (30).
 - (g) With air tank assembly (3) securely supported, loosen adapter (19) and carefully remove air tank assembly (30).
 - (h) Remove elbows (5) from air tank assembly (30).
 - (i) Remove hose (30), connector (14), and bushing (16) from frame coupler (18).
 - (j) Remove adapter (19) and frame coupler (18).
- b. Disassembly. Disassemble the air compressor, alcohol injector, and air governor assemblies as follows:
- (1) Complete removal procedures per paragraph 5-5.11a before disassembling the air compressor assembly as follows:
 - (a) Remove valve holder (9, fig. 5-206), and valve assembly (10).
 - (b) Remove valve assembly (4).
 - (c) Remove screws (2), lockwashers (3), head (21), o-ring (22), and valve assembly (15).
 - (d) Remove screws (29), lockwashers (30), liner (28), and o-ring (31).
 - (e) Remove clips (39), pin (4), and piston (41).
 - (f) Remove rings (38).
 - (g) Position crankshaft (47) to facilitate removal of rod assembly (32). Remove screws (34), washers (35), nuts (36), and rod assembly (32).
 - (h) Remove cap (33), and rod bearing (37).
 - (i) Remove nut (26), lockwasher (37), pulley (25), and key (48).
 - (j) Remove screws (43), lockwashers (44), bolt (42), bearing (46), crankshaft (47), and bearings (49 and 50).
 - (k) Remove elbows (23 and 24) from crankcase (51).

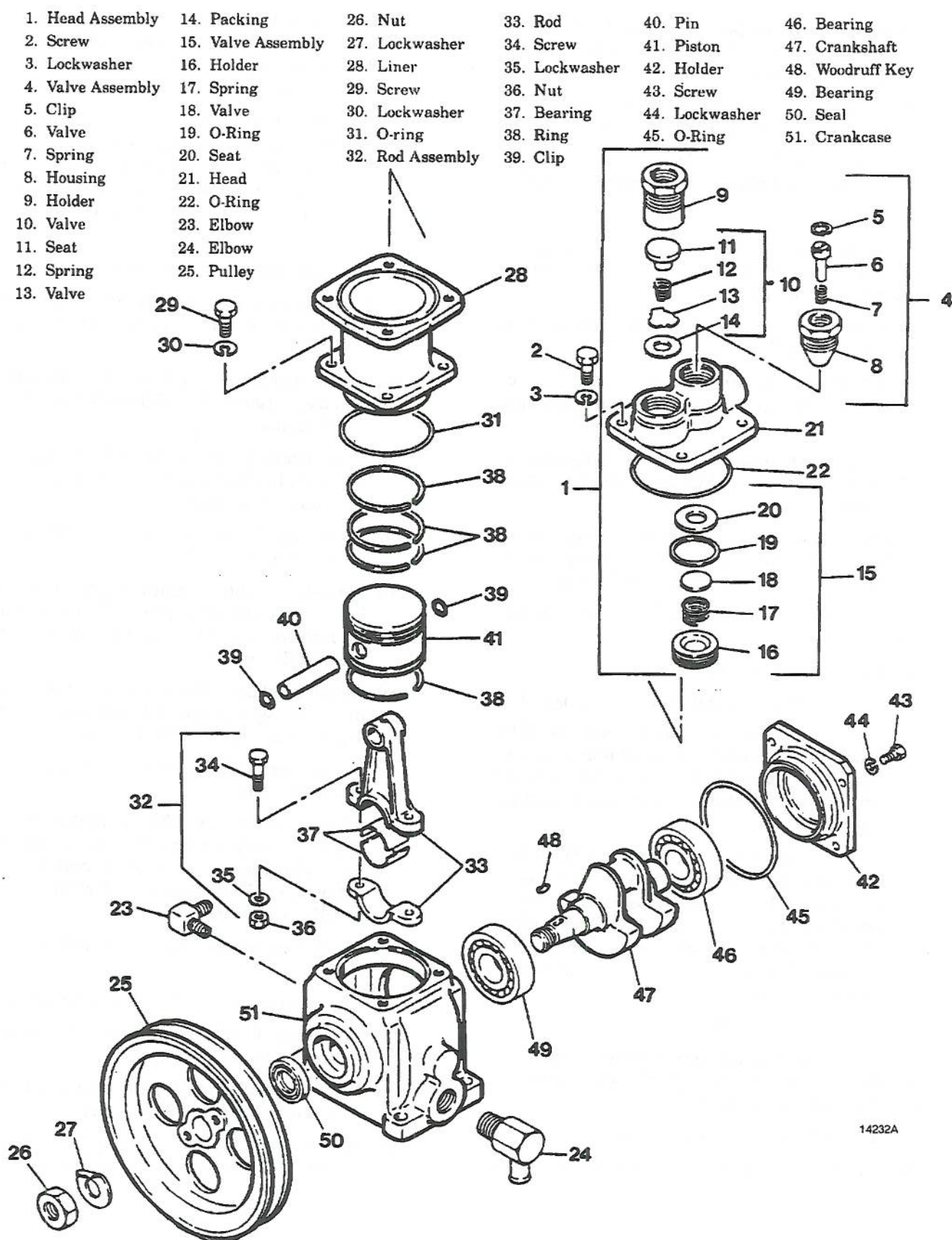


Figure 5-206. Air Compressor Assembly

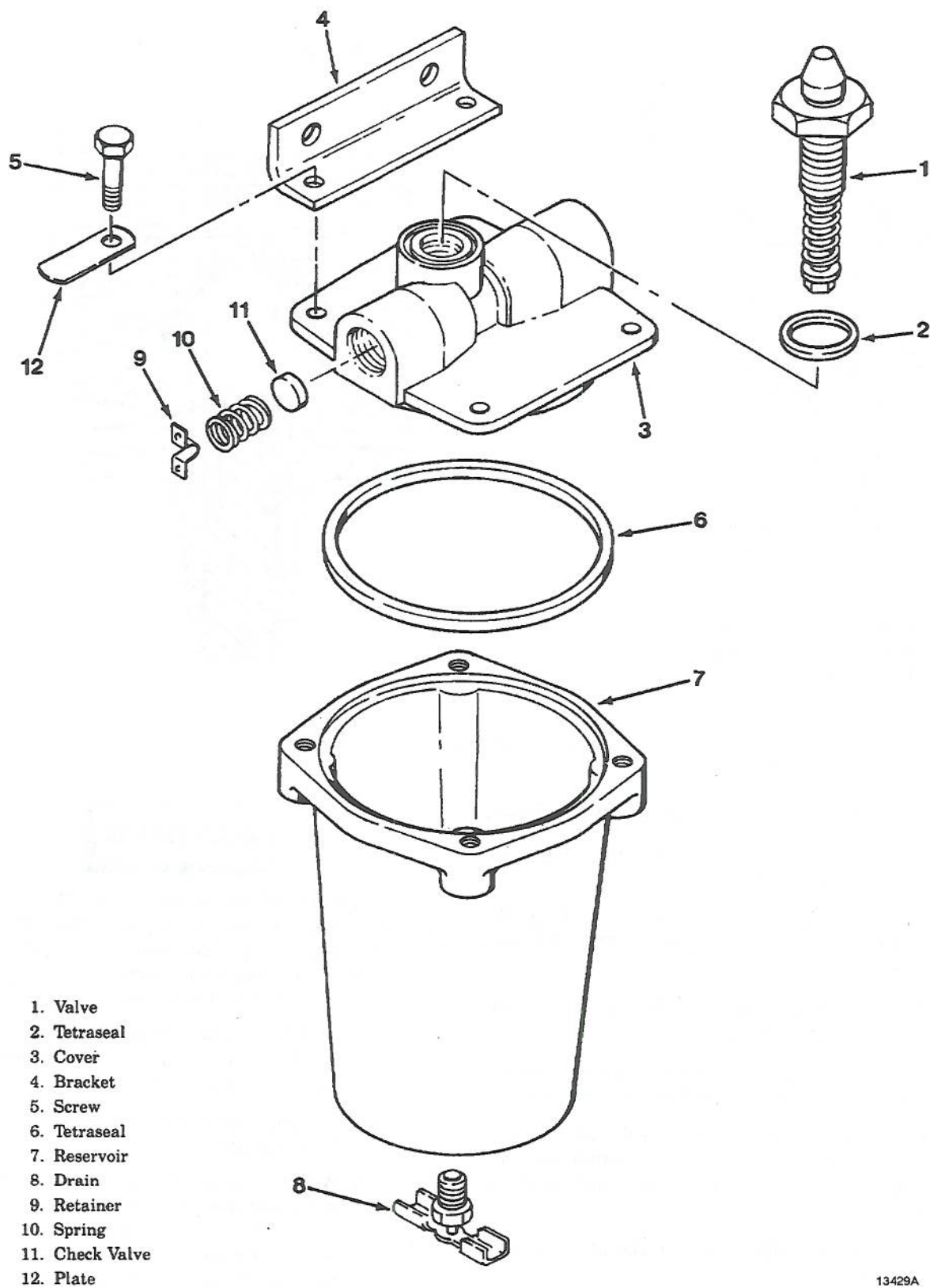
- (2) Complete removal procedures per paragraph 5-5.11a before disassembling the alcohol injector assembly as follows:
 - (a) Remove valve (1, fig. 5-207), tetraseal (2), retainer (9), spring (8), and check valve (11).
 - (b) Remove screws (5), plate (12), bracket (4), cover (3), and tetraseal (6) from reservoir (7).
 - (c) Remove drain cock (8).
- (3) Complete removal procedures per paragraph 5-5.11a before disassembling the air governor assembly as follows:
 - (a) Remove screws (4 fig. 5-208), filter (1), o-rings (2 and 5).
 - (b) Remove screw (6), springs (11 and 12), retainer (10), cap (9), spring (8), and diaphragm (7) from housing (13).
- c. Cleaning and inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- d. Assembly. Assemble air compressor, alcohol injector, and air governor before attempting any installation procedure per paragraph 5-5.11e.
 - (1) Assemble the air compressor assembly as follows:
 - (a) Install oil seal (5, fig. 5-206).
 - (b) Press bearings (46 and 49) on crankshaft (47).
 - (c) Insert crankshaft (47) into crankcase (51). Align bearing (149) to bearing bore in crankcase (51). Carefully press in bearings (49 and 46). Ensure crankshaft turns freely with no end play.
 - (d) Install o-ring (45) in crankcase (51). Place bearing holder (42) to crankcase (51), ensure bearing (46) mates with machined bore in bearing holder (42). Attach bearing holder (42) with screws (43) and washers (44). Tighten screws (43) to 16-19 in.-lb and ensure crankshaft turns freely.

NOTE

When installing piston rings remember to stagger ring slots preventing loss of compression and or damage to the liner.

- (e) Install rings (38) to piston (41).
- (f) Install clip (391) into one end of piston (41).

- (g) Insert rod (33) into piston (41) and align holes. Insert pin (40) through piston and rod (33). Install remaining clip (39) into other end of piston (41).
- (h) Lubricate bearing (37). Install bearing (37) and rod (33) to crankshaft (47) with screws (34), washers (35), and nuts (36). Tighten screws to 185-200 in.-lb. Ensure no end play exists between the crankshaft (47) and rod (33).
- (i) Lubricate piston (41) and rings (38).
- (j) Compress piston rings (38) using a ring compressor tool, and insert piston (41) into liner (28).
- (k) Attach liner (28) to crankcase (51) with screws (29) and washers (30). Tighten screws (29) to 25-30 ft.-lbs.
- (l) Insert packing (14), valve (13), spring (12), and seal (11) into head (21). Thread and tighten holder (9) to head (21).
- (m) Insert seat (2), o-ring (19), valve (18), spring (17), and holder (16).
- (n) Thread and tighten housing (8) into head (21). Insert valve (6) onto spring (7). Insert valve (6) into housing (8). Press down on valve (8) and install clip (5).
- (o) Attach head assembly (1), and o-ring (22) to liner (28) with screws (2) and washers (3). Tighten screws (2) to 35-48 in.-lbs.
- (p) Thread and tighten elbows (23 and 24) to crankcase (51).
- (q) Place woodruff key (48) on crankshaft (47). Carefully press pulley (25) onto crankshaft (47). Attach pulley (25) to crankshaft (47) with lockwasher (27) and nut (26). Tighten nut (26) to 185-210 in.-lb.
- (2) Assemble the alcohol injector assembly as follows:
 - (a) Thread drain (8, fig. 5-207) to reservoir (7).
 - (b) Install check valve (11), spring (10), and retainer (9) into cover (3).
 - (c) Place tetraseal (2) on top of cover (3). Thread and tighten safety valve to cover (3).
 - (d) Attach plate (12), bracket (4), cover (3), and tetraseal (6) to reservoir (7) with screws (5).



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Figure 5-207. Alcohol Injector Assembly

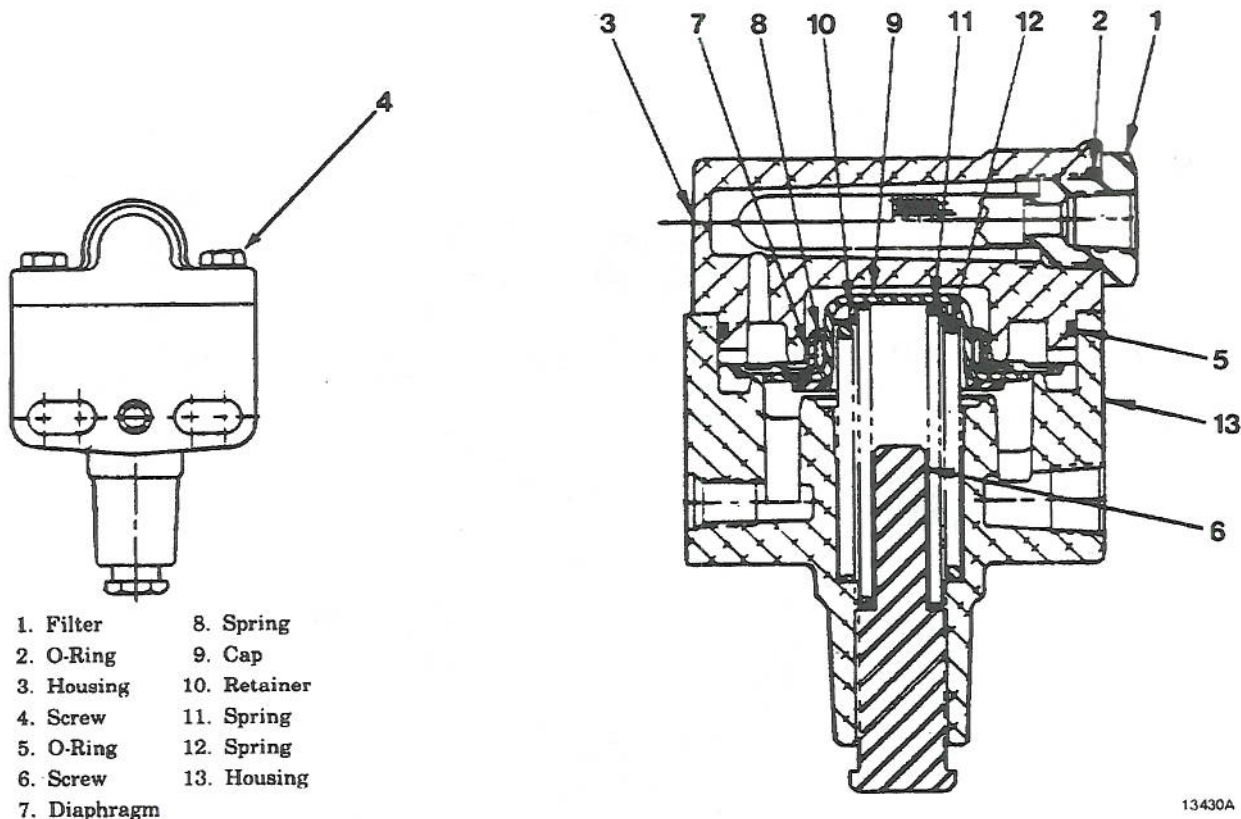


Figure 5-208. Governor Assembly

(3) Assemble the air governor assembly as follows:

- (a) Thread screw (6, fig. 5-208) fully clockwise into housing (13).
 - (b) Insert diaphragm (7), cap (9), spring (8), springs (11 and 12), and retainer (10) into housing (13).
 - (c) Place o-ring (2) into housing (3). Thread filter (1) into housing (3).
 - (d) Place o-ring (5) into housing (13). Attach housing (3) to housing (13) with screws (4).
- e. Installation. Raise and secure vehicle as necessary to facilitate installation of component parts under chassis. Install air system components as follows:
- (1) Install right-hand air tank and component parts as follows:
 - (a) Attach bushing (16, fig. 5-203), connector (14), and hose (30) to frame coupler (18).
 - (b) Attach elbows (5) to air tank assembly (30).

WARNING

Before attempting installation of the air tank assembly, it must be safely supported. The support is used to protect maintenance personnel from severe injury if the tank would drop suddenly during installation procedures.

- (c) Slowly raise tank to position for installation. Once tank is in position, thread and tighten adapters (19 and 17).
 - (d) Attach bushing (16), connector (14), and hose (15) to adapter (17).
 - (e) Attach heater and drain valve assembly (21) to air tank assembly (30) and tighten adapter. Attach all electrical wiring. Attach ground wire to chassis with screw (20). Thread drain plug into heater and drain valve assembly.
 - (f) Attach hoses (10 and 11) to elbows (5).
- (2) Install left-hand air tank and component parts as follows:

- (a) Attach bushing (16), connector (14), and hose (13) to frame coupler (18).
- (b) Attach relief valve (29) and elbow (28) to air tank (30). Connect hose (27) to elbow (28).

WARNING

Before attempting installation of the air tank assembly, it must be safely supported. The support is used to protect maintenance personnel from severe injury if the tank would drop suddenly during installation procedures.

- (c) Slowly raise tank to position for installation. Once tank is in position, thread and tighten adapters (19 and 17).
 - (d) Thread coupling (25), check valve (24), and elbow (23) to pipe (26).
 - (e) Thread pipe (26) into adapter (17).
 - (f) Attach hose (22) to elbow (23).
 - (g) Attach heater and drain valve assembly (21) to air tank assembly (30) and tighten adapter. Attach all electrical wiring. Attach ground wire to chassis with screw (20). Thread drain plug into heater and drain valve assembly.
- (3) Install component parts located under and on dashboard as follows:
- (a) Attach wires and switch (54) to dashboard.
 - (b) Attach wires (32) to buzzer (45). Attach buzzer (45) to dashboard with screws (46).
 - (c) Attach connector (36) to gauge (47). Attach gauge (47) to dashboard with screws (48).
 - (d) Attach switch (34) to elbow (37). Attach elbow (39) to elbow (37).
 - (e) Attach wires (32) to switch (34). Attach hoses (15 and 38) to elbow (39). Attach hose (35) to elbow (37).
 - (f) Thread elbow (5) and switch (42) to tee (43).
 - (g) Thread nipple (44) into valve (49).
 - (h) Thread tee (43) to nipple (44).
 - (i) Thread elbow (5) to valve (49).
 - (j) Attach bracket (51) to dashboard with screws (52).
 - (k) Attach valve (49) to bracket (51) with bolts (50).
 - (l) Attach wires (33) to switch (42).
 - (m) Attach hoses (36 and 38) to elbows (5).
- (4) Install rear gladhand and valve assembly as follows:
- (a) Attach frame stud (4) to frame.
 - (b) Thread elbow (5) to frame stud (4).
 - (c) Attach hose (11) to elbow (5).
 - (d) Thread valve (8), nipple (7), and gladhand (6) to frame stud (4).
 - (e) Attach coupling (1) to gladhand (6).
- (5) Install rear gladhand assembly as follows:
- (a) Attach frame stud (4) to frame.
 - (b) Thread elbow (5) to frame stud (4).
 - (c) Attach hose (12) to elbow (5).
 - (d) Thread gladhand (2) to frame stud (4).
 - (e) Attach coupling (1) to gladhand (2).
- (6) Install front gladhand and valve assembly as follows:
- (a) Attach frame stud (4) to frame.
 - (b) Thread elbow (5) to frame stud (4).
 - (c) Attach hose (1) to elbow (5).
 - (d) Thread elbow (3), valve (8), nipple (7), and gladhand (2) to frame stud (4).
 - (e) Attach coupling (1) to gladhand (2).
- (7) Attach front gladhand assembly as follows:
- (a) Attach frame stud (4) to frame.
 - (b) Thread elbow (5) to frame stud (4).
 - (c) Attach hose (9) to elbow (5).
 - (d) Thread elbow (3) and gladhand (2) to frame stud (4).
 - (e) Attach coupling (1) to gladhand (2).
- (8) Attach hoses (9, 12, and 31) to tee (74).
 - (9) Attach governor assembly (59) with screws (60).
 - (10) Attach hoses (27 and 56) to governor assembly (59).
 - (11) Attach alcohol injector assembly (64) to mounting bracket (67) with bolts (65) and nuts (66).
 - (12) Attach hoses (61 and 22) to connector (62) and elbow (63).
 - (13) Attach bracket (8, fig. 5-205) with lockwashers (10) and nuts (9).

- (14) Attach compressor (6) to bracket (8) with screws (7).
 - (15) Attach both ends of hose (2) and tighten clamps (3).
 - (16) Clamp tube (4), and attach to connector (5) and compressor (6).
 - (17) Install the idler pulley assembly as follows:
 - (a) Thread screw (8, fig. 5-204) through bolt (7) until threads from screw (8) just appear through bolt (7).
 - (b) Insert bolt (7) through bracket (9).
 - (c) Place spacer (6) and shield (5) on bolt (7).
 - (d) Thread pulley (41) on bolt (7) by turning pulley clockwise.
 - (e) Place gasket (3) on top of thermostat assembly.
 - (f) Attach bracket (9), gasket (3), and outlet (1) with screws (2).
 - (18) Place belt (58, fig. 5-203) around pulleys. Tighten belt (58) by turning bolt (8) clockwise until not more than 1 inch of play is attained.
- f. Testing. Perform testing procedures as follows:

WARNING

Depressurize system before attempting any service or repair that requires disassembly of any pressurized components. Severe injury or death can result if system remains pressurized during any component removal.

Do not work under raised vehicle without first supporting vehicle with safety jack stands or injury to personnel could result.

CAUTION

Check engine oil level fill and change oil as required. Severe damage to air compressor can result from insufficient oil flow.

- (1) Remove hose (61, fig 5-203), and elbow (72).
- (2) Attach a pressure gauge (0-200 psi) and tee to air outlet of air compressor. Attach hose (61) to other end of tee.
- (3) Start engine and allow to idle. Check for oil leakage, noise (bearing whine or knocking) from air compressor or belt noise. Ensure any problems are corrected before proceeding with testing.

- (4) Ensure drain plugs (21) are correctly installed.
- (5) Start engine and set idle to specifications as necessary. At pressures below 60 psi air compressor will fill tanks. At 100 psi air governor will unload (vent) air flow.
- (6) Observe attached pressure gauge, the air governor should unload pressure between 100-125 psi. If governor unloads between the min-max values the system is functioning correctly. If not adjust the air governor by turning adjusting screw (6, fig 5-208) in to increase and out to decrease unload pressure.
- (7) After all adjustments are completed depressurize system.
- (8) Remove hose (61, fig 5-203), tee, and valve from air compressor air outlet.
- (9) Thread elbow (72) and attach hose (61).
- (10) Start engine and let idle. Air compressor should fill system in 5-7 minutes and then unload (vent) air. Time the fill cycle. If over 7 minutes check system for air leaks. If no leaks are found this indicates an internal problem with air compressor that must be corrected.

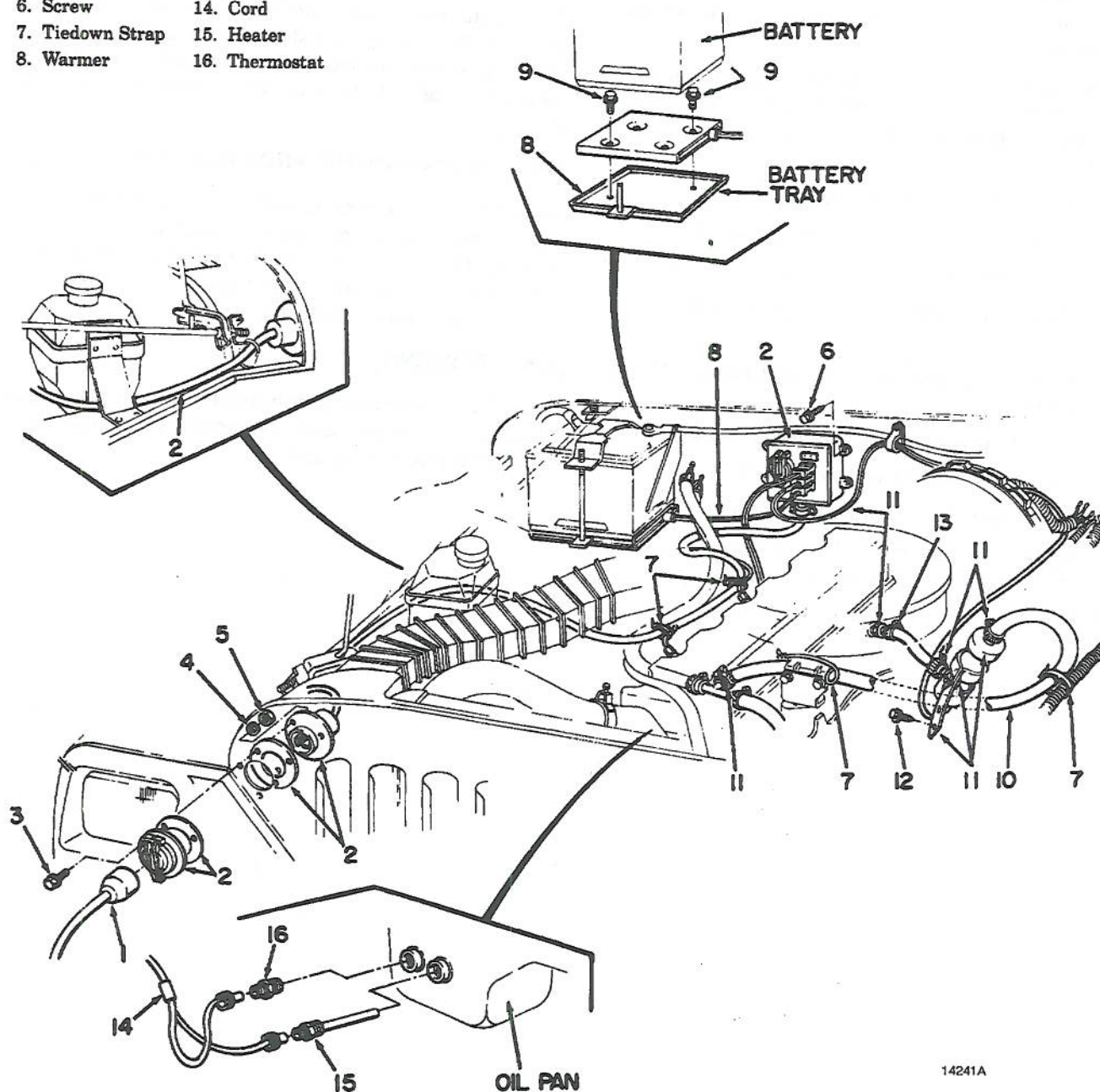
5-5.12 *Winterization Kit*. Disassembly procedures are preformed during removal procedures.

WARNING

Do not work under raised vehicle without first supporting vehicle with safety jack stands or injury to personnel may result.

- a. Removal. Remove any tiedown straps to facilitate removal of any component. Remove component parts from the winterization kit as follows:
 - (1) Disconnect power cable (1, fig 5-209), and plugs from box assembly (2).
 - (2) Remove screws (3), lockwashers (4), nuts (5), screws (6) and box assembly (2).
 - (3) Remove battery per paragraph 4-4.6.
 - (4) Remove screws (9) and warmer (8).
 - (5) Drain oil from vehicle per paragraph 4-4.4.
 - (6) Remove cord assembly (14) from heater (15) and thermostat (16).
 - (7) Remove heater (15) and thermostat (16).

- | | |
|------------------|----------------|
| 1. Cable | 9. Screw |
| 2. Box Assembly | 10. Hose |
| 3. Screw | 11. Heater |
| 4. Lockwasher | 12. Screw |
| 5. Nut | 13. Clamp |
| 6. Screw | 14. Cord |
| 7. Tiedown Strap | 15. Heater |
| 8. Warmer | 16. Thermostat |



14241A

Figure 5-209. Winterization Kit

- (8) Drain coolant from vehicle per paragraph 4-4.2.
- (9) Loosen clamps (13) and remove hose (10).
- (10) Remove screws (2) and heater (11).
- b. Cleaning and Inspection. Refer to paragraphs 5-4.3 and 5-4.4 for general cleaning and inspection procedures.
- c. Installation. Install all tiedown straps during installation of component parts removed during removal procedures. Install winterization kit as follows:
 - (1) Attach heater (11) with screws (2).
 - (2) Attach hoses (1) and tighten clamps (13).
 - (3) Add coolant to vehicle per paragraph 4-4.2.
 - (4) Thread thermostat (16) and heater (15) to oil pan.
 - (5) Attach cord assembly (16) and heater (15) to oil pan.
 - (6) Add oil to vehicle per paragraph 4-4.4.
 - (7) Attach warmer (8) with screws (9).
 - (8) Install battery per paragraph 4-4.6.
 - (9) Attach box assembly (2) with screws (6), nuts (5), lockwashers (4), and screws (3).
 - (10) Connect power cable (1) as necessary.

5-6. STORAGE.

Assemblies or components which will be stored before reinstallation must be preserved according to approved procedures. Bare steel parts should be sprayed or dipped in corrosion preventive compound (13, table 5-1) Type II, or a mixture of one part Type I and three parts engine oil. All components should be wrapped in plastic sheeting or moistureproof paper, with all exposed ports plugged or taped to keep out dust, moisture or foreign material.

5-7. WORKMANSHIP AND HANDLING.

Maintenance practices should be of the highest standard. Obtain the proper tools for each task before beginning the work. Keep work area clean. New parts should not be laid out where they will be exposed to dirt or dust before installation.

5-8. PAINTING.

Procedures for painting are limited to touch-up and spot painting. Use green paint (34, table 5-1) and use standard shop practices to apply.

CHAPTER 6

Table of Limits

6-1. INTRODUCTION.

This chapter presents data regarding fits, clearances, tolerances and torque values for use when inspecting and reassembling the components listed.

6-2. TABLE OF LIMITS.

Refer to table 6-1 for details regarding fits, clearances and tolerances when reassembling the components list-

ed. The minimum and maximum tolerances are set up as ideal limits. Part measurements that do not fall outside the replacement minimum/maximum values may be continued in service. The table also contains values to be used for proper adjustment and setting of equipment during replacement or reassembly of the components listed.

Table 6-1. Table of Limits

Figure		Description	Min	Max	Replacement	
No.	Ref				Min	Max
Engine						
5-8	6,7 8	Armature shaft-to-bushing clearance A				0.0079
		Armature shaft-to-bushing clearance B				0.0177
		Armature shaft-to-bushing clearance C				0.0079
		Armature shaft-to-bushing clearance D				0.0079
		Armature shaft alignment				0.0039
		Commutator wear			0.016	
		Commutator insulation depth			0.0075	0.0075
		Brush wear				0.5
		Brush spring tension			1.87 fp	7.75 fp
5-23	34	Vane measurements - length	1.167	1.18		
	17	Vane measurements - width	0.492	0.55		
		Slip rings wear limit			1.20	
		Slip ring out-of-round				0.012
		Brush wear limit			0.295	
5-31		Battery specific gravity	1.250	1.265		
5-33	1	Alternator belt deflection	0.3	0.5		
5-34	29	Thermostat-maximum expansion temperature		180°F		
5-37	26	Fuel pump housing-to-piston clearance	10.539	10.551		
	33	Tappet assembly roller-to-pin clearance				0.0059
5-38	19	Nozzle and holder assembly injection start pressure	1422.3 psi			

Table 6-1. Table of Limits-Continued

Figure		Description	Min	Max	Replacement	
No.	Ref				Min	Max
Engine-Continued						
5-42	16	Plate assembly warp				0.0079
5-48	7	Backlash between camshaft and crankshaft gears	0.0028	0.0079		0.012
	11	Measured camshaft bend				0.0039
	11	Camshaft bend		0.0012		0.0024
	20,21, 23,24	Rocker valve-to-valve stem clearance (cold engine)				0.014
	20,21, 23,24	Rocker valve-to-shaft clearance				0.0059
	25	Rocker shaft bend				0.0118
	1	Camshaft lobe height	1.448			
	29	Lifter valve-to-bore clearance				0.0039
5-50	1	Glow plug resistance			0.13 ohms	0.19 ohms
5-52	5	Lateral runout of clutch contacting surface of flywheel		0.0059		
		Crankshaft end play - uncorrected				0.0157
		Crankshaft end play - corrected		0.0055		
		Crankshaft backlash			0.0028	0.0079
5-54	6,7	Between gears-to-cover clearance				0.0059
	6,7	Gear teeth tips-to-case clearance				0.0098
	6,7	Pump gear backlash				0.0197
	9,10	Shaft diameters	0.5889	0.5896		0.0039
	9	Drive shaft-to-body clearance	0.0049			
5-56	3	Piston ring clearance (1st compression ring)				0.02
	3	Piston ring clearance (2nd and 3rd compression ring)				0.012
	3	Oil ring clearance				0.0059
	3	Piston ring-to-cylinder gap				0.0059
		Connecting rod end play				0.0079

Table 6-1. Table of Limits-Continued

Figure		Description	Min	Max	Replacement			
No.	Ref				Min	Max		
Engine-Continued								
5-56 -cont.	2	Piston pin-to-bore clearance				0.0039		
		Bushing-to-piston pin clearance				0.0039		
		Bearing shell metal-to-connecting rod journal clearance				0.0059 +0.012/- 0.016		
		Piston top clearance						
		Main bearing journal out-of-round				0.004		
		Clearance between bearing shell and journal				0.0059		
		Circularity of connecting rod journal				0.0004		
		Clearance between connecting rod journal and connecting rod bearing shells				0.0059		
		Reground journal-to-bearing clearance-main bearing	0.0014	0.0037				
		Reground journal-to-bearing clearance connecting rod	0.0014	0.0034				
		Radius dimension - main journal				0.118		
		Radius dimension - connecting rod				0.138		
		5-68	14	Top surface of engine block - top surface angle:				
				-longitudinal		0.00389		
-transverse			0.00079					
6	Cylinder liner - wear				0.0119	0.00789		
	Vertical variation					0.00789		
14	Cylinder block - height wear limit				10.54			
Transmission								
5-76	1	Transmission - end play	0.036	0.084				
5-80	26 9,13	Retaining ring thickness-rear clutch			0.25	0.45		
		front clutch			0.082	0.151		
		Rear clutch-to-front clutch thrust washer thickness			0.061	0.063		

Table 6-1. Table of Limits-Continued

Figure		Description	Min	Max	Replacement	
No.	Ref				Min	Max
Transmission-Continued						
5-81	2	Pump rotor surface clearance	0.001	0.003		
	2	Pump rotor tip clearance	0.004	0.008		
Steering						
5-103		Steering gear ring end gap	4 in.-lb 8 in.-lb			
		Pitman shaft drag torque	to previously measured wormshaft bearing			
		adjustment: new gears - add	preload. Do not exceed combined total of 14 in.-lb.			
		Used gears (400 or more miles)-add	4 in.-lb 5 in.-lb			
			to previously measured wormshaft bearing			
		Caster	4° (+1°)			
		Camber	0° (+1/2°)			
		Toe-in	3/64 to 3/32 in.			
		Turning angle	19° (±1/2°)			
		Frame height	26 in. (± 1/2 in.)			
Rear Axle						
5-126		Rear axle housing spreader indicator setting	0.015			
		Flange runout	0.002			
		Ring gear-to-carrier flange clearance	0.0015			
		Carrier flange-to-bearings clearance	0.0015			
Brakes						
5-135		Front brake disc thickness			1.215	
		Disc lateral runout				0.005
		Disc thickness variation				0.001

6-1. MISCELLANEOUS TABLE.

Refer to table 6-2 for torque values and spring pressures on particular assemblies or components. Standard torque specifications are listed separately in table 6-3 and may be used when specific

torque references are not given for a part. Torque values listed are based on use of clean and dry threads. Reduce torque by 10 percent when threads are lubricated with engine oil and by 20 percent if new plated screws are used.

Table 6-2. Specific Torque Values

Capscrews And Nuts				
Location	Ref	Figure No.	Torque ft-lb (Nm)	
			Min	Max
Exhaust and intake manifold	3	5-5	10.8(14.9)	13.0(17.6)
Exhaust pipe to manifold	3	5-5	20.0(27.1)	27.0(36.6)
Starter motor mounting bolts	18	5-7	18.0(24.4)	
Alternator hex head capscrow	2	5-7	20.0(27.1)	
Alternator mounting screw	1,7	5-7	30.0(40.6)	
Starting motor attaching bolts		5-8	18.0(24.4)	
Pulley nut	2	5-23	50.0(67.7)	
Battery cable assembly connections		5-31	75(101.6)	
Thermostat housing mounting screws	21	5-34	9.0(12.2)	
Waterpump mounting screws	12,13,14	5-34	25.0(33.8)	
Feed pump stud bolt		5-37	2.2(2.7)	2.9(4.0)
Feed pump lock nut		5-37	3.6(5.4)	5.1(6.7)
Spill tube nut	12	5-38	72.3(97.6)	86.8(117.9)
Overflow nut	11	5-38	28.9(39.3)	36.2(48.8)
Oil cooler center bolt	7	5-41	18.08(24.4)	21.7(29.8)
Oil cooler pipe bolts	26,30,31	5-41	7.23(9.4)	9.4(12.2)
Oil cooler mounting bolts	28,29	5-41	7.23(9.4)	9.4(12.2)
Front plate assembly mounting bolts	3	5-42	7.23(9.4)	9.4(12.2)
Timing gear case	3,2,4,5	5-42	7.23(9.4)	9.4(12.2)
Crankshaft pulley nut	5-42	216.9(294.2)	238.6(324.0)	
Timing gear cover	8,9	5-42	7.23(9.4)	9.24(12.2)
Main cylinder head screws	8	5-46	43.4(58.3)	
Sub-cylinder head screws	9	5-46	21.7(29.8)	
Center bolt	3	5-48	32.6(44.7)	36.2(48.8)
Rocker shaft bolts	13	5-48	14.5(20.3)	18.1(24.4)
Attaching bolts	9	5-48	2.9(4.0)	4.3(5.4)
Flywheel	6	5-52	32.6(44.7)	36.2(48.8)
Oil pan mounting (engine)	2,3	5-53	5.0(6.7)	6.5(9.4)
Oil pan drain plug	5,6	5-53	36.2	43.4
Oil pump strainer	3	5-54	4.34(5.4)	5.06(6.7)
Oil pump cover	5	5-54	9.4(12.2)	13.74(17.6)
Oil pump mounting	1	5-54	9.4(12.2)	13.74(17.6)
Connecting rod	4	5-56	37.6(51.5)	41.2(55.5)
Crankshaft	8	5-56	216.9(294.2)	238.6(324.0)
Adapter to transmission	9	5-76	26.0(35.2)	

Table 6-2. Specific Torque Values - Continued

Capscrews And Nuts				
Location	Ref	Figure No.	Torque ft-lb (Nm)	
			Min	Max
Transmission assembly to engine	20	5-76	28.0(37.9)	21.7(29.8)
Oil filter center bolt	7	5-41	18.08(24.4)	
Oil filter tube mounting	4	5-76	150.0(203.3)	
Oil pan mounting	17	5-76	150.0 in. -lb (16.94)	
Drive plate/adaptor/flywheel assembly to crankshaft	4	5-79	52.0(70.5)	21.7(29.8)
Drive plate to torque converter	2	5-79	23.0(31)	
Valve body mounting	41	5-78	8.3(10.8)	
Kickdown band		5-80	35.0(47.4)	
Rear band		5-80	35.0(47.4)	
Reaction shaft support assembly	8	5-81	160.0(216.9)	
Oil pump housing mounting	3	5-81	175.0(237.2)	
Bearing strap	2	5-82	15.0(20.3)	
Low range lockplate	19	5-83	30.0(40.6)	
Case half attaching	12	5-83	23.0(31.1)	
Retainer bolts	10	5-83	23.0(31.1)	
Transfer case to transmission		5-83	40.0(54.2)	
Yoke nut	35,36	5-84	120.0(162.6)	
Plate	2	5-95	18.0(24.4)	
Pump mounting bracket	15	5-112	30.0(40.6)	
Bracket assembly	10,12,19	5-112	30.0(40.6)	
Mounting stud nuts		5-115	35.0(47.5)	
Adjusting bracket nuts		5-115	20.0(27.1)	
Front shock absorber	3 (upper)	5-116	35.0(47.4)	
	3 (lower)	5-116	45.0(61.0)	
Front stabilizer bar	3	5-117	55.0(74.5)	
Front stabilizer bar	11	5-117	35.0(47.4)	
Knuckle assembly	15	5-121	100.0(135.5)	
Spring U-bolt	3 (4.2")	5-121	44.0(59.6)	
Spring U-bolt	3 (3.6")	5-121	100.0(135.5)	
Spring shackle and pivot	7,8	5-121	100.0(135.5)	
Rear shock absorber (upper)	3	5-122	35(47.4)	
Rear shock absorber (lower)	3	5-122	45(61.0)	
Rear spring	2,6,9	5-125	35(47.4)	
Bearing assembly locknut		5-128	50.0(67.7)	
Axle shaft capscrew		5-128	30.0(40.6)	
Wheel mounts	8	5-130	80(108.4)	
Master cylinder	2	5-131	30(40.6)	
Power brake booster	17,19	5-131	35(47.4)	
Brake pedal screw and nut		5-131	35(47.4)	

Table 6-2. Specific Torque Values-Continued

Capscrews And Nuts-Continued				
Location	Ref	Figure No.	Torque ft-lb (Nm)	
			Min	Max
Front brake caliper (brake lines)	(bolts) 14 (9/16 in.) 14 (1/2 in.) 2	5-134	13(17.6)	35(47.4)
Front brake caliper		5-134	35(47.4)	
Rear spring		5-134	100(135.5)	
Rear spring		5-134	55(74.5)	
Horn mounting screw		5-162	15(20.3)	
Front seat frame mounting screws		5-166	15(20.3)	
Seat and shoulder belts attaching bolts		5-169	25(33.8)	
Steering wheel nut		5-190	35(47.4)	
Steering System Components				
Steering gear clamp mounting screws	28	5-103	10(13.5)	
Adjuster plug locknut	4	5-103	85(115.2)	
Adjuster plug	5	5-103	20(27.1)	
Sidcover mounting capscrews	20	5-103	45(61.0)	
End plug	34	5-103	75(101.6)	
Locknut	4	5-103	85(45.2)	
	10	5-103		
Locknut	15	5-103	20(27.1)	
Stubshaft tubing clamp screw		5-103	30(40.6)	
Gear mounting capscrews	2	5-103	70(94.9)	
Pitman arm nut	25	5-103	185(250.8)	
Steering gear hose clamp screws (pressure & return)		5-103	25(33.8)	
Capscrews	27	5-110	30(40.6)	
Tie rod	23	5-110	60(81.3)	
Connecting rod to tie rod	4	5-110	70(94.9)	
Power steering arm	16	5-110	185(250.8)	
Connecting rod to power steering arm	12	5-110	70(94.9)	
Tie rod bracket assembly	3	5-111	30(40.6)	
Tie rod bracket assembly	4	5-111	30(40.6)	
Shroud to housing attaching screws		5-100	(18 in.-lb)(2.03)	
Upper housing mounting	23	5-100	(60 in.-lb)(6.7)	
Turn signal mounting	16	5-100	(35 in.-lb)(3.9)	
Lever attaching screw	21	5-100	(35 in.-lb)(3.9)	
Steering wheel locknut	2	5-100	30(40.6)	
Lower shaft mounting	43	5-102	45(61.0)	
Steering shaft mounting	34	5-102	45(61.0)	

Table 6-2. Specific Torque Values-Continued

Capscrews And Nuts-Continued				
Location	Ref	Figure No.	Torque ft-lb (Nm)	
			Min	Max
Ignition switch mounting	11	5-102	(35 in.-lb)(3.9)	
Plate mounting	18,20	5-102	(60 in.-lb)(6.7)	
Bracket assembly to column mounting	13	5-102	20(27.1)	
Bracket assembly to instrument panel mounting	14	5-102	20(27.1)	
Steering wheel locknut	2	5-99	30(40.6)	

Table 6-3. General Torque Values

Capscrew Body Size inches-thread	SAE Grade 1 Of 2 Torque ft-lb(Nm)	SAE Grade 5 Torque ft-lb(Nm)	SAE Grade 6 Or 7 Torque ft-lb(Nm)	SAE Grade 8 Torque ft-lb(Nm)
1/4-20	5(6.7)	8(10.8)	10(13.5)	12(16.2)
-28	6(8.1)	10(13.5)		14(18.9)
5/16-18	11(14.9)	17(23.0)	19(25.7)	24(32.5)
-24	13(17.6)	19(25.7)		27(36.6)
3/8-16	18(24.4)	31(42.0)	34(46.0)	44(59.6)
-24	20(27.1)	35(47.4)		49(66.4)
7/16-14	28(37.9)	49(66.4)	55(74.5)	70(94.9)
-20	30(40.6)	55(74.5)		78(105.7)
1/2-13	39(52.8)	75(101.6)	85(115.2)	105(142.3)
-20	41(55.5)	85(115.2)		120(162.6)
9/16-12	51(69.1)	110(149.1)	120(162.6)	155(210.1)
-18	55(74.5)	120(162.6)		170(230.4)
5/8-11	83(112.5)	150(203.3)	167(226.4)	210(284.7)
-18	95(128.8)	170(230.4)		240(325.3)
3/4-10	105(142.3)	270(366.0)	280(379.6)	375(508.4)
-16	115(155.9)	295(399.9)		420(569.4)
7/8-9	160(216.9)	395(535.5)	440(596.5)	605(820.2)
-14	175(237.2)	535(725.3)		675(915.1)
1-8	235(318.6)	590(799.9)	660(894.8)	910(1233.7)
-14	250(338.9)	660(894.8)		990(1342.2)